

NORSTAR **INDUSTRIES, INC.**

RS 6000 Injection Sprayer Manual



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Gasoline Driven Injection Skid with Cable Plug Set v6.6

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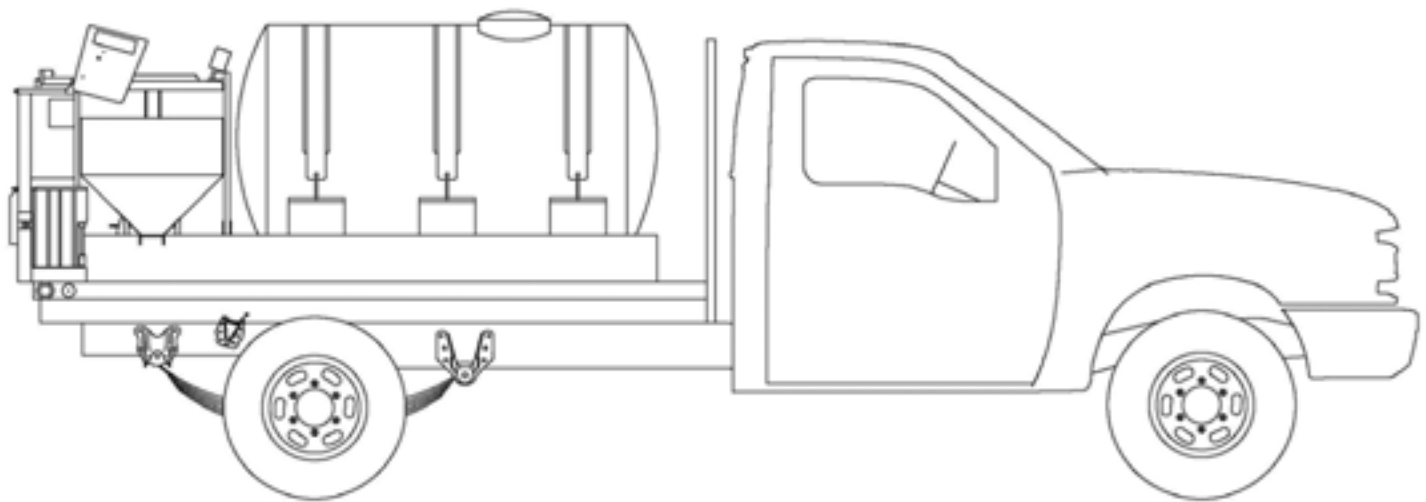
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RS 6000 ROADSIDE SPRAYER

INTRODUCTION

Congratulations on the purchase of your Norstar RS6000 Roadside Sprayer. This is a state of the art sprayer for the precise application of herbicides to roadside vegetation. The RS6000 Sprayer uses a TASC 6300 chemical injection system to automatically monitor and control the precise amount of chemical being applied per acre. Each chemical is stored in a separate chemical tank then automatically injected into the water pump at the rate set by the operator. The use of the injection system eliminates any need for premixing the chemical in the sprayer water tank. The mixture is then applied through a low drift boomless sprayhead. This allows the operator to make changes in rates as needed to eliminate over or under application.

We are continually striving to make improvements on the Norstar RS6000 system to keep it the best unit available today. To do this we welcome input from our users so please phone or drop us a line with your comments.

GENERAL DESCRIPTION

The Norstar RS6000 sprayer provides precise chemical application from a boomless sprayhead mounted behind the operator. The sprayhead contains 7 individually controlled boom sections. The sprayhead can be tilted from an in-cab control console to compensate for changes in ditch or embankment slopes.

The RS6000 sprayer has the ability to inject up to three chemicals at a time (6 available with optional Tasc 6600 console). The system injects chemical accurately by using a computer to monitor vehicle ground speed, spray width, and the pre-set chemical application rates. The chemicals are injected at the water pump inlet and thoroughly mixed with water. The mixture is then distributed through the boomless sprayhead manifold to multiple nozzle assemblies. Regardless of changes in ground speed or spray width the computer will automatically maintain chemical injection at the operator's preset application rates.

RS6000 SPRAYER OPERATING SPECIFICATIONS

- Sprayhead is mounted behind the operator to maximize operator safety and to minimize chemical injection lag time.
- All solid stream nozzles are used requiring maximum operating pressures of only 15 to 30 P.S.I.
- Multiple spray sections provide superior spray width flexibility.
- Centrifugal water pump capable of providing 70 to 100 P.S.I.

OPERATION START-UP

NOTE: Before initial start-up of this machine both the RS6000 manual and the TASC manual should be read completely. For training, calibration, and testing *NORSTAR INDUSTRIES INC.* recommends water be used in lieu of chemical until the operators feel comfortable with the operation of the machine.

1. Before filling make sure all valves are in the closed position.
2. Fill the main water tank with water.
3. Load chemical into the desired chemical tank(s), refer to the Chemical Loading section for instructions.
4. To install the chemical pump tube, release the tube retaining strap and lift it up and away from the tube rollers.
5. Clean the chemical pump tube rollers and retaining strap with a cloth to remove any dirt or grit from the tube running area.
6. Lubricate the pump tube with tube lube then attach one hose quick disconnect fitting to the left hose connection. Loop the tube over the rollers and down between the tube rollers and tube strap hinge (there is not enough space to between the tube roller assembly and the tube strap hinge to slip the tube in from the front without the possibility of damaging the tube). Stretch the tube enough to lock the right hose quick disconnect fitting in place. To prevent air leaks in the chemical lines, make sure the gaskets does not fall out or get twisted and that both fittings are tightened securely. Swivel the tube retaining strap back into place and secure with the latch.
7. Open the chemical tank valves **ONLY** after the tube retaining strap has been secured with the latch.
8. Open both water tank outlet valves, and then momentarily open the tank drain valve at the water pump inlet to purge the lines of air for initial priming.
9. Start the water pump engine or vehicle engine if the water pump is hydraulically driven.
10. Turn all chemical pump switches off on the TASC Console. Turn on the master switch and a boom switch on the RS6000 console. Now turn the water pump switch on for 45 seconds. This should be enough time to see water discharging through the sprayhead nozzles that you turned on. If not, turn off the water pump switch, open the small drain cock on top of the water pump and allow it to run until air is bled out. This process may have to be repeated several times to completely purge the air out of the system.

WARNING: Running the pump without water will cause damage to the pump seals.

11. Once the water pump is primed each sprayhead boom switch should be turned on and off several times to bleed the air out of the solenoid diaphragms. Bleeding air from the solenoids may be required each time the unit runs out of water.

WARNING: Do not allow the water pump to run for more than a 5 minutes with all boom switches off. This can cause water pump damage due to overheating.

12. At this point the machine is ready for calibration, (refer to page 23).

CAUTION: Calibration is necessary on initial start-up, or when a pump tube is replaced. Also check calibration if application rates seem to be off.

CHEMICAL LOADING

WARNING: Protective gear should be worn when handling any chemical.

STANDARD LOADING

1. Close all valves on the chemical tanks.
2. Remove the lid.
3. Pour the desired amount of liquid chemical into the chemical tank and replace the lid.
4. Powders and granular chemicals must be mixed with water. Add water to the chemical tank first, then add the chemical. The chemical should be poured in slowly while agitating until a thoroughly mixed slurry is achieved.

NOTE: Constant agitation is required to keep powders and granular chemicals in suspension.

CLOSED LOADING SYSTEM (OPTIONAL)

LOAD CHEMICAL TANK(S)

- ***At the closed load manifold:***
 1. Attach the chemical probe hose to the flat face quick disconnect located at the bottom of the manifold.
 2. Place the chemical probe in the product container.
 3. Turn the ball valve for the chemical probe to “Load” as indicated on the label.
 4. Turn the ball valve for the desired chemical tank to “Load” as indicated on the label.
- ***At the bottom of the chemical tank to be filled:***
 5. Close the ball valve to the chemical pump.
 6. Open the ball valve to the chemical tank.
 7. Ensure the drain ball valve is closed.
- ***At the transfer pump:***
 8. Select the proper calibration factor on the meter. See Sotera Model 850 Meter CAL Factor Selection Procedure for instructions (refer to page 6).
 9. Turn the transfer pump on and fill until the desired quantity of product is in the tank.
 10. When finished, turn the pump off and move the ball valves on the closed loading manifold to the off position.

UNLOAD CHEMICAL TANK(S)

- ***At the closed load manifold:***
 1. Attach the chemical probe hose to the flat face quick disconnect located at the bottom of the manifold.
 2. Place the chemical probe in the product container.
 3. Turn the ball valve for the chemical probe to “Unload” as indicated on the label.
 4. Turn the ball valve for the chemical tank to be unloaded to “Unload” as indicated on the label.
- ***At the bottom of the chemical tank to be emptied:***
 5. Close the ball valve to the chemical pump.
 6. Open the ball valve to the chemical tank.
 7. Ensure the drain ball valve is closed.
- ***At the transfer pump:***
 8. Turn the transfer pump on.
 9. When finished, turn the ball valves on the closed loading manifold to their off positions.

Transfer Chemical Between Onboard Tanks

- ***At the closed load manifold:***
 1. Turn the ball valve for the chemical tank to transfer **FROM** to “Unload” as indicated on the label.
 2. Turn the ball valve for the chemical tank to transfer **TO** to “Load” as indicated on the label.
- ***At the bottom of the chemical tank to transfer to and transfer from:***
 3. Close the ball valve to the chemical pump.
 4. Open the ball valve to the chemical tank.
 5. Ensure the drain ball valve is closed.
- ***At the transfer pump:***
 6. Turn the transfer pump on until the desired amount of product is transferred.
 7. When finished, turn the ball valves on the closed loading manifold to their off positions.

System Flush

- ***At the closed load manifold:***
 1. Turn the ball valve(s) for the chemical tank line(s) to be flushed to “Load” as indicated on the label.
 2. Turn the water ball valve on the top of the manifold on.
- ***At the bottom of the chemical tanks whose lines are to be flushed:***
 3. Turn the ball valve to the chemical pump on.
 4. Turn the ball valve to the chemical tank off.
 5. Ensure the drain ball valve is closed.
- ***At the transfer pump:***
 8. Turn the transfer pump on.
 9. Continue normal spraying with the chemical pumps on until the chemical lines are clear.
 10. When finished, turn the ball valves on the closed loading manifold to their off positions.

WARNING: All ball valves on the closed loading manifold should be in the OFF position when not in use or chemical mixing between tanks can occur.

Sotera 850 Digital Meter CAL Factor Selection Procedure

Change Calibration Factor

1. Turn the meter on.
2. Press and hold button 3 for 3 seconds. Only CAL and the number below it will be displayed.
3. Use the supplied chemical chart to select the proper calibration factor based upon the chemical being used and the temperature.
4. Press button 3 repeatedly to change the number to the desired calibration factor. The number will return to zero after reaching 19.
5. Press button 2 to set the number – the meter is now ready to use.

Product Not Listed On Chart

If a product does not appear on the supplied chart, a calibration (CAL) factor can be selected using a calibration container. Each CAL factor represents 1% accuracy; so on a 5 gallon calibration container 1% is 0.05 gallons. Follow the procedure listed below to determine the correct CAL factor.

1. Turn the meter on.
2. Change the CAL factor to 4.
3. Prime the system so no air is present.
4. Dispense the product into a calibration container.

5. Determine the amount of product that was dispensed into the container and compare to the meter reading. If the volume displayed on the meter is less than the amount dispensed, select a lower CAL factor. If the volume displayed on the meter is higher than the amount dispensed select a higher CAL factor.
6. Subtract the measured value from the meter reading to obtain the difference.
7. Divide the difference by the accuracy value (1% of the calibration container volume) to find how much to change the CAL factor.
8. Add the result to the current CAL factor to obtain the correct CAL factor for the product.

Example:

With the CAL factor set at 4, a product is dispensed into a 5-gallon calibration container.

The calibration container reads 5.00 gallons and the meter reads 5.35 gallons. Therefore, a higher calibration factor is needed.

The difference is then 0.35 gallons:

$$5.35 \text{ gallons (meter reading)} - 5.00 \text{ gallons (measured value)} = 0.35 \text{ gallons}$$

The CAL factor change would then be 7:

$$\frac{0.35 \text{ gallons}}{0.05 \text{ gallons}} = 7 \quad \text{or} \quad \frac{0.35 \text{ gallons}}{1\% \times 5 \text{ gallons}} = 7$$

The correct CAL factor for the product would now be 11:

$$4 \text{ (previous CAL number)} + 7 \text{ (calculated change value)} = 11$$

Sotera 850 digital meter recalibration procedure, battery replacement, parts drawing and troubleshooting guide can be found on pages 66 - 68.

Calibration (CAL) Factor Table

[illegible]

[†] Fluid temperature in mini bulk tanks stored outdoors will be approximately the average of the daily high and low temperatures.

CHEMICAL RATES

The Norstar system provides the ability to make speed and width changes without effecting the chemical application rate. The TASC console monitors ground speed and spray widths, automatically increasing or decreasing the speed of each chemical injection pump to maintain preset chemical application rates. Application rates for the water (carrier) differs from chemical in that it is fixed. The gallon per acre (GPA) of water increases as the vehicle speed decreases.

NOTE: Care must be taken in the selection of chemical rates to insure the label rates for carrier and chemicals are followed.

FLUID OUNCES CONVERSION TABLE

1 Pint	=	16 Fluid Ounces
2 Pints = 1 Quart	=	32 Fluid Ounces
4 Pints = 2 Quarts	=	64 Fluid Ounces
8 Pints = 4 Quarts = 1 Gallon	=	128 Fluid Ounces

SINGLE CHEMICALS

The single chemical is loaded in the chemical tank, then the ounces per acre application rate is installed in that chemical pump application rate position on the TASC console.

MULTIPLE CHEMICALS IN ONE TANK

WARNING: Chemical compatibility should be checked prior to mixing in the chemical tank. Contact the chemical supplier for their recommendation and also mix up a test batch.

Herbicides and additives are commonly mixed in one tank when they are normally dispensed at the same time. For example: if your application rate is 2 Quarts (64 oz.) per acre of herbicide and 1 Pint (16 oz.) per acre of surfactant, then both go into the tank at that ratio. The chemical rate you put in the computer would be the total of both application rates or 80 oz. per acre.

NOTE: Accumulated values will be the total of all chemicals in tank.

WETTABLE POWDERS AND GRANULARS

Label rates for powders and granular chemicals are generally labeled in ounces or pounds per acre. To inject these chemicals a slurry must be made by mixing water with the chemical. We suggest using a small quantity to start. For example, start with 1 gallon of water, then add 1 lb. of measured powder and mix thoroughly. Measure the total liquid volume of the mixture. The total liquid volume will be greater than the 1 gallon of water. For example: 128 oz. of water mixed with 1 lb. of powder could possibly make a slurry with a total volume of 132 oz. This is the rate you put in the TASC console if you are applying one pound of chemical per acre.

APPLICATION TIPS:

1. Periodic calibrations should be performed to ensure an accurate application.
2. Use suspenders and anti-foam agents very carefully.
3. Do not allow mixture to stand in tank without agitation for long periods.
4. Mix only what you will use in that day, and flush tank and lines after use to eliminate a blockage.

NOTE: Multiple chemicals can be added same as the liquids described on previous page using the same ratio.

WARNING: DO NOT add **drift control** agents to the slurry mixture or problems can occur.

CHEMICAL TANK LEVEL INDICATORS (OPTIONAL)

Six indicator lights are located in the RS6000 control console. The lights are wired to float switches in the bottom of each chemical tank. When the material level drops below the float level, the tank indicator will come on.

WARNING: Care must be taken not to damage float switch in tank bottom when mixing chemical with anything other than standard agitator.

NOTE: Due to chemical residue accumulating around the float switch, fresh water rinsing is required on a regular basis to insure proper operation.

DRIFT CONTROL SYSTEM (OPTIONAL)

The drift control system uses a venturi to draw the material out of a chemical tank, through a flow control and solenoid valve, and injects it at the inlet of the water pump. The solenoid valve opens and closes with the master switch on the TASC 6300 console. This will eliminate loading the water pump up with material when sprayhead solenoids are closed but the water pump is still running. The flow control is used to regulate the rate of material being used.

Operation

1. Fill the drift control tank with product.
2. Open the tank shut off valve
3. To adjust the flow control valve to the desired injection rate, start at the lowest setting (first color ring) and working up by monitoring the usage over a few tanks of water.

NOTE: Use only drift control products in the 1-% concentrate category like Exacto's Formula 358, Nalco's Sta-Put or similar products.

WARNING: When the drift control tank is empty, the shut off valve must be closed for proper water pump operation.

OPERATION SHUTDOWN

1. If granular or dry flowable chemicals are used we recommend you flush the chemical tank and lines with water before step #2.

NOTE: With optional closed loading system, close the valve at the bottom of the chemical tank and open the valve to the chemical pump. At the closed loading panel select the water position, open valve on the panel for chemical tank to be flushed, and turn on power switch. Repeat for each chemical pump.

2. Run all the chemical pumps until all sprayhead nozzles show clear water.

NOTE: Cycling boom solenoids off and on several times works the best for a system flush.

3. Close all water tank and chemical tank outlet valves.

WARNING: All valves must be closed when sprayer is not being used to ensure chemical does not contaminate main water tank.

4. Release the tube retaining strap on Legacy chemical pumps. Remove tubes from under rollers on older style chemical pumps.
5. Turn the power switches on the TASC and the RS6000 consoles to the off position. This will prevent battery drain.
6. Unit is ready for storage at above freezing temperatures. For below freezing temperatures see the winterizing section.

MAINTENANCE SCHEDULE

DAILY

1. Check the oil in the auxiliary engine or hydraulic tank as required.
2. Inspect the nozzles on the sprayhead for build up and clean with a soft bristled brush if necessary.
3. Check the spray pattern for uniform coverage and adjust as needed.
4. Check operating pressures of the sprayhead boom sections at regulator gauges.
5. Inspect all chemical tanks and lines for possible damage.
6. Clean and inspect the chemical pump tubes, rollers and housing for wear or damage.
7. Lubricate the chemical pump tube with the correct tube lube only.
8. Check all calibration numbers in the TASC 6300 console.

WEEKLY

1. Clean the face of the radar unit with a damp soft cloth.
2. Clean the water pump inlet and outlet strainers (daily when water quality is poor).

AS REQUIRED

1. Disassemble, clean, and inspect the solenoids, replacing diaphragms as needed.
2. Remove and clean the regulator screens located under the large hex, behind the gauge on each regulator.
3. Check pressures of individual sprayhead boom sections using a calibration gauge.
4. Clean the air filter and change the oil in auxiliary engine if so equipped (see engine owners manual).
5. Change the hydraulic return filter after the first 150 hours, then 500 hours after that if so equipped.
6. Clear ¼" bypass line between water pump and injection point at the water pump at least once a season. More often if powders are used.

WARNING: Disconnect all battery cables to the RS6000 system if **ANY WELDING** is done on chassis. Disconnecting the power will not erase the information stored in the console.

WATER PUMP PRESSURE ADJUSTMENT

NOTE: Maximum water pump pressure is 100 PSI with solenoids closed (deadheaded).

ENGINE DRIVEN

1. Start auxiliary engine and allow the engine to warm up.
2. Turn on the water pump switch and run water through a few sprayhead boom sections to ensure no air is trapped in the pump.
3. With all sprayhead boom switches off (deadheaded), the pressure on the main system gauge should indicate 75 - 80 PSI.
4. To change the pressure increase or decrease the engine throttle as required.

HYDRAULIC DRIVEN

1. Start chassis engine and set throttle at high idle (1000 RPM).
2. Turn on the water pump switch and run water through a few boom sections to ensure no air is trapped in the pump.
3. With all boom sections off (deadheaded), the pressure on the main system gauge should indicate 75 - 80 PSI.
4. To change the pressure, loosen the jamb nut on the water pump speed control knob (hydraulic flow control), make the required adjustment and tighten jamb nut.

SPRAYHEAD NOZZLE PRESSURE ADJUSTMENT

NOTE: Main pump pressure should be checked before setting sprayhead boom sections.

1. Disconnect the power wire located on the back of nutating motor.
2. Remove one nozzle from the #1 sprayhead section. Install a calibration gauge and tube assembly (part # NS3110) in the open #1 nozzle hole with the nozzle installed in the end of calibration tube. Position the gauge so other nozzles do not spray on the gauge.
3. Start the water pump and turn on #1 sprayhead boom section.
4. Check the pressure on the gauge installed and adjust if required (see nozzle chart specific to sprayhead assembly).

NOTE: Pressure gauges on the solenoid regulator are for reference only. They will indicate a higher pressure than calibration gauge due to pressure drops.

5. If an adjustment is necessary, loosen the jamb nut on the tee handle at the back of the regulator for # 1 nozzle assembly.
6. Turn the tee handle clockwise to increase pressure and counter clockwise to reduce pressure then tighten the jamb nut.
7. Turn the sprayhead boom section on and off a few times and re-check pressure.
8. Turn off the sprayhead boom section, stop the water pump and remove the calibration gauge.
9. Repeat the procedure on all sprayhead nozzle assemblies
10. Connect the power wire on nutating motor.
11. Check the spray pattern and adjust as needed.

SPRAYHEAD NOZZLE SETUP

The standard Norstar RS6000 Nutating sprayhead is supplied with nozzles that apply water (carrier) at a rate of 35 gallons per acre at 11 MPH. This is achieved by taking pressure readings directly at the nozzle assemblies and adjusting the individual regulators to the values shown on the tables below. The use of solid stream nozzles reduces drift, but it is recommended that drift control agents also be used.

STANDARD NOZZLE SET

35 GPA @ 11 MPH - C-CAM

Boom Section	Nozzle	Qty	Width	Pressure
#1	S1/8U-0006	4	2' (24")	20 PSI
#2	S1/8U-0007	3	2' (24")	20 PSI
#3	S1/8U-0011	4	4' (48")	20 PSI
#4	S1/8U-0014	3	4' (48")	20 PSI
#5	H1/8U-0010	4	4' (48")	25 PSI
#6	H1/8U-0014	4	6' (72")	25 PSI
#7	H1/8U-0014	4	6' (72")	25 PSI

OPTIONAL NOZZLE SETS

25 GPA @ 11 MPH - C-CAM

Boom Section	Nozzle	Qty	Width	Pressure
#1	S1/8U-0004	4	2' (24")	20 PSI
#2	S1/8U-0005	3	2' (24")	20 PSI
#3	S1/8U-0007	4	4' (48")	20 PSI
#4	S1/8U-0010	3	4' (48")	20 PSI
#5	H1/8U-0007	4	4' (48")	25 PSI
#6	H1/8U-0010	4	6' (72")	25 PSI
#7	H1/8U-0010	4	6' (72")	25 PSI

50 GPA @ 11 MPH - C-CAM

Boom Section	Nozzle	Qty	Width	Pressure
#1	S1/8U-0008	4	2' (24")	20 PSI
#2	S1/8U-0010	3	2' (24")	20 PSI
#3	S1/8U-0015	4	4' (48")	20 PSI
#4	S1/8U-0020	3	4' (48")	20 PSI
#5	H1/8U-0013	4	4' (48")	25 PSI
#6	H1/8U-0020	4	6' (72")	25 PSI
#7	H1/8U-0020	4	6' (72")	25 PSI

NOTE: For special nozzle requirements consult the factory.

WINTERIZING

1. Empty the chemical tanks completely and flush thoroughly with water.
2. Open both water tank outlet valves and drain valve. Close them after tank is completely empty.
3. Fill each chemical tank with one half-gallon of RV antifreeze.

NOTE: With optional closed loading, use the chemical probe in the antifreeze container to load tanks. This will fill the tanks and also protect the closed loading system.

4. Install the chemical pump tubes, secure tube retaining strap with the latch, and open the chemical tank valves
5. With the water pump **NOT RUNNING** turn on the TASC console, all chemical pump switches, and all sprayhead solenoid switches.
6. Turn the sprayhead boom width switch to auto, display selector to test speed, and set a 15 mph test speed.
7. Turn on the master switch, which should cause the chemical pumps to inject antifreeze into the water pump. Run all pumps until tanks are empty.
8. Fill one tank with the remainder of antifreeze and use only 1 pump to finish.
9. Shut off each sprayhead boom section switch as antifreeze is seen coming out of the respective nozzles.
10. Turn off the master switch, set the boom width switch to B or C, and open one of the water tank outlet valves. Note: The wider the setting will cause the pump to run faster.
11. Turn on section #9. It may require plugging off the section with a QD cap or crimping the hose to keep material from being discarded out of the boom section.
12. Turn on the master switch until antifreeze is seen in water tank then shut off the master switch.
13. Close the water tank outlet valve and repeat the procedure with the second valve.
14. Use the same procedure as the water tank to fill the hose reel. Be sure to lock the handgun trigger on and open the handgun feed line valve before starting pumps. Do not close feed line valve or release handgun trigger with pumps running.

NOTE: Winterizing your sprayer should take approximately 2 - 3 gallons of antifreeze

RS 6000 ROADSIDE SPRAYER

HANDGUN OPERATION

TASC 6000/6300/6600 MANUAL SUPPLEMENT

TASC roadside operations require, at least, TASC software level 3.10 or above, the inclusion of an external handgun function switch, an interface cable and a flow switch in the handgun feed line.

There are special features of the TASC available to Roadside Applicators in both the handgun and normal modes. The handgun option allows the user to set chemical injection rates based on carrier flow rates, (i.e., ounces per 100 gallons of carrier.) Pumps start and stop in response to the start of carrier flow sensed by a flow sensing switch. Chemical injection will only occur when the handgun trigger is pulled and flow is established.

SET-UP MODE FUNCTIONS: First put the TASC in the handgun mode. To do this, set the mode switch on the RS 6000 console to "HANDGUN". Now, Turn the TASC power "ON" and put the mode selector switch to "SET-UP".

The following programming functions are available in the TASC console:

- SPEED:** An "Err" message will appear (GSO is not available in the handgun mode.)
- AREA:** Area will not accumulate in handgun mode.
- CHEM., CHEM. APPLIED:** This is the pump calibration number for each injection pump (see Section 2.8 in the TASC manual.)
- CHEM., CHEM. RATE:** With pump switch in the "ON" position, program the rate as ounces per 100 gallons of carrier (use the INC/DEC switch to set this rate.) With pump switch in the "ALT": position, the display will read as a ratio (i.e. 1:100 ,1gal. or "128 oz." chemical to 100 gal. Carrier). The pump can be programmed in either position.
- CHEMICAL, % RATE:** Use the INC/DEC switch to select the desired rate change % for chemicals.
- CARRIER RATE:** Use the INC/DEC switch to set the desired carrier rate to zero, "**0**" **GALLONS PER MINUTE**. The console will operate in a **MONITOR ONLY MODE** regulating flow by the handgun nozzle size and pressure.
- CARRIER TOTAL APPLIED:** The flow meter calibration number (310.0 /801 flow meter – 153.1/standard flow meter)
- WIDTH:** The message "none" will appear (boom width is not used in the handgun mode.)
- DISTANCE:** The distance calibration number (Section 2.7 in the TASC Manual.)
- PRIME:** The prime volume for each pump (Section 2.8.4 in the TASC Manual.)
- SCAN:** An "Err" message will appear (there is no programming in SCAN.)

OPERATE MODE FUNCTIONS: Now put the TASC mode selector switch to “OPERATE”.

The following programming functions are available in the TASC console:

SPEED:	This is a direct reading of ground speed.
AREA:	Area will not accumulate in the handgun mode.
CHEM., CHEM. APPLIED:	Accumulated ounces as they are applied, switches to hundredths of gallons after 256 ounces are accumulated.
CHEM., CHEM. RATE:	This register will indicate the programmed standard rate, regardless of the switch position “ON” or “ALT” the display will read as a ratio (i.e. 1:100 ,1gal.or”128 oz.” chemical to 100 gal. Carrier).
CHEMICAL % RATE:	Allows changing chemical injection rates a preset per-percentage (Section 3.4.2.1 in the TASC Manual.)
CARRIER RATE:	The display will show “Flow Contl OFF Auto, Handgun” with no flow and the actual carrier flow rate in gallons per minute once flow is established.
CARRIER TOTAL APPLIED:	Accumulated gallons applied.
WIDTH:	“None” (boom widths are not used in the handgun mode.)
DISTANCE:	Accumulated distance in feet or miles.
PRIME:	Used for priming the injection pumps (section 3.5 in the TASC Manual.)
TEST SPEED:	The gallons per minute programmed in the “SET-UP” mode is displayed.
SCAN:	Scans information in the accumulators and registers.

SPECIAL CONSIDERATIONS WHEN USING THE HANDGUN MODE:

- A. PUMP CALIBRATIONS: The speed of the injection pumps during calibration is determined by the programmed test speed (gallons per minute) and the programmed chemical application rate (ounces per 100 gallons.) Set these numbers to your typical operating conditions before doing the pump calibrations.
- B. The injection pumps will operate at the speed necessary to apply the correct amount of chemical according to the **actual** carrier application rate. The pump speed will change to compensate for changes in carrier flow.
- C. Booms are not used in the handgun mode. If the TASC senses a boom “ON” condition, it will indicate an “Err” and will stop the injection pumps.
- D. The values programmed into the TASC console while in the handgun mode will remain in console memory, even when the normal mode is selected. Any time the handgun mode is again selected, these values will automatically be present in the TASC console.
- E. Selecting TEST SPEED on the TASC console, while in the “OPERATE” mode, will cause injection pumps to control to the programmed test rate.

TYPICAL OPERATION IN THE HANDGUN MODE

- A. Set the mode switch on the RS 6000 console to “handgun”, Master switch, Boom switches, and the Ground Speed Override Switch to “OFF”:
- B. Select “SET-UP” for the TASC console mode selector. Program the TASC console as necessary (See SET-UP Mode, Page 1.)
- C. Zero the accumulated rates as necessary.
- D. Select “OPERATE” with the TASC console mode selector switch
- E. Turn “ON” the desired chemical injection pumps.
- F. Be sure the carrier pump is operating. Open handgun shutoff valve, depress the handgun trigger and the chemical injection pumps will be activated at the speed necessary to apply the desired rates of ounces per hundred gallons according to the actual carrier rate. There is no delay to the control of the injection pumps. (NOTE: the carrier flow rate is the sum of the carrier and the injected chemicals.)

WARNING: Rapid triggering of handgun can cause incorrect application or inadvertent error messages.

- G. Releasing the handgun trigger will cause the chemical injection pumps to stop immediately.
- H. Set the Auto / B / C / Handgun rotary switch to “Auto” and the TASC console will then be ready for the previously programmed broadcast spraying operations.

ERROR MESSAGES AND RESPONSES IN THE HANDGUN MODE (See also, Section 8.0 in the TASC Manual)

Error-1: “Error - 1, Pump #” This indicates the displayed pump is running at its maximum rate. An Error-1 condition lasting more than 5 seconds will cause all the injection pumps to stop injecting. Check power connections and programming. Check that the pump is large enough for the desired flow. Once the problem is corrected, Error-1, Pump # is cleared by first selecting “Auto” and then returning to the “Handgun” mode on the switch panel.

Error-3: “Error - 3, Pump #” This indicates there are no sensor pulses being received from the displayed pump. An Error-3 condition lasting more than 5 seconds will cause all the injection pumps to stop injecting. Check power, ground and fuses on the pump power cable. Check the programming. Check if the pump runs before the error condition occurs. Once the problem is corrected, Error-3, Pump # is cleared by first selecting “Auto” and then returning to the “Handgun” mode on the switch panel.

Error-4: “Error - 4, Pump #” An Error-4 condition indicates that the displayed injection pump is running when it should be off. An Error-4 condition will immediately cause all the injection pumps to stop injecting. Check for normal operation of the injection pump. Error-4, Pump # is cleared by first selecting “Auto” and then returning to the “Handgun” mode on the switch panel. The pump driver module may need to be replaced if the problem persists.

BOOM WIDTHS FOR SPECIAL PURPOSES, Normal Operations Only

For broadcast spraying operations, separate widths can be programmed into the “B” or “C” widths on the TASC console. Select the “B” Width or “C” Width on the RS 6000 console. Select the width display function and the “SET-UP” mode on the TASC console. Enter the desired width in inches.

Now, whenever boom width “B” or “C” is selected on the switch panel, the TASC console will automatically adjust its Chemical output for the programmed width, regardless of the width programmed for the individual boom sections.

LEGACY PUMP CALIBRATION

PUMP TUBE INSTALLATION



TYPICAL PUMP CALIBRATION NUMBERS

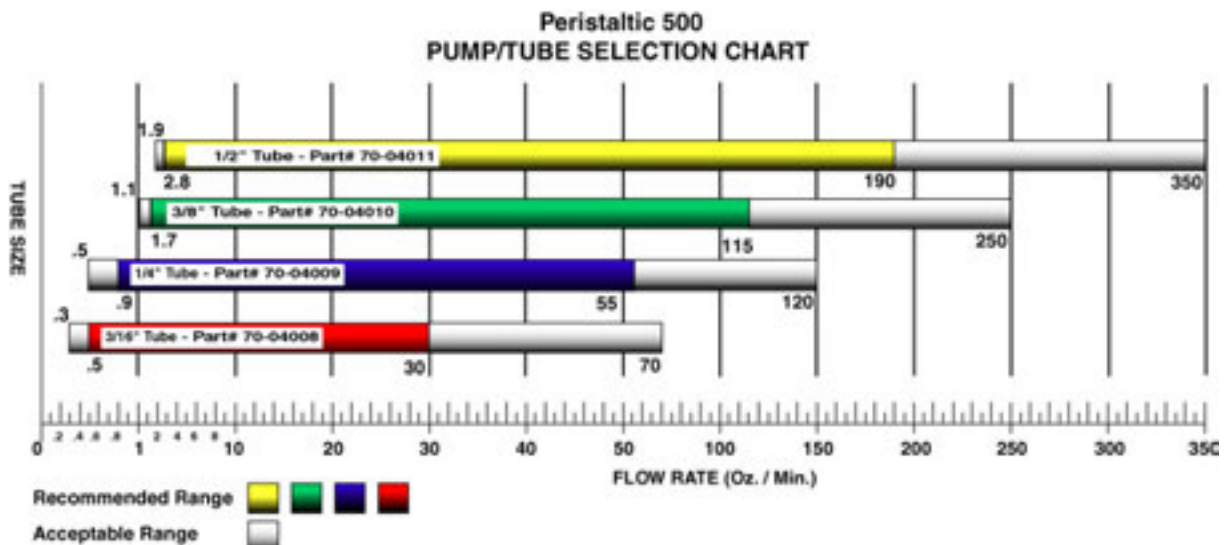
The pump calibration number (PC#) is a value that relates to the volume of chemical output during each revolution of the injection pump and is used by the TASC Control Console to determine each pump's actual discharge rate. Pump calibration numbers may differ slightly from one pump to the next.

SELECTING THE PROPER PUMP TUBE

Use the following formula to determine the flow capacity requirements of your application; then check the Pump Tube Selection Chart below for the pump tube size.

$$\text{Pump Capacity} = \text{Maximum Boom Width} \times \text{Maximum Speed} \times \text{Target Chemical Rate} \times (.00202)$$
$$(\text{Ounces per Min}) = (\text{Max Feet}) \quad \times \quad (\text{Max MPH}) \quad \times (\text{Target Oz. per Acre}) \times (.00202)$$

Example: A sprayer with 12 ft. booms, traveling at a maximum speed of 11 mph and applying 64 oz. of chemical per acre would require a maximum pump capacity of 17.6 oz. per min. (i.e. 12 ft. x 11 mph x 64 oz. per acre x .00202 = 17.6 oz. per min). Referring to the Pump Tube Selection Chart we find that a 3/16 inch pump tube would be the best choice for this rate. However, if you need to apply 128 oz. per ac. of chemical, you should use the 1/4 inch pump tube; the calculated 34.1 oz. per min. exceeds the recommended range of the smaller 3/16 inch tube.



FOR BEST PERFORMANCE CHOOSE THE SMALLEST PUMP TUBE THAT MEETS CALCULATED FLOW RATE (OUNCES PER MINUTE)

PUMP TUBE CALIBRATION NUMBERS

Typical Legacy pump calibration numbers for Prothane tubes listed on the previous page are:

- 3/16" Tube (Red) 32
- 1/4" Tube (Blue) 55
- 3/8" Tube (Green) 110
- 1/2" Tube (Yellow) 180

All other chemical pumps refer to section 2.8 in Tasc Manual

PUMP CALIBRATION PROCEDURE

TO ENSURE AN ACCURATE CALIBRATION PLEASE FOLLOW THE PROCEDURE EXACTLY!

The following field procedure is recommended to check or calibrate the injection pumps. This procedure requires a catch basin or container of at least 60 Oz. with graduation marks. In this example, a 56 Oz. test is described. There is nothing magic about the 56 Oz. number, in fact, collecting more material leads to smaller measurement errors. However, it is important to get a very accurate measurement of the volume of fluid (Fl. oz.) collected. In this example we will be calibrating Pump #1, the procedure is the same for all pumps.

NOTE: MID-TECH suggests doing all calibrations using water to keep the procedure as simple and safe as possible; however, it may be necessary to calibrate with the actual chemical if it is an extremely thick, heavy or viscous fluid.

Check the current Pump Calibration Number and Application Rate (pump to be calibrated) and Test Speed values. These should be typical for your sprayer operations. If not, reset them to a typical value, (Refer to Sections 2.3.2. & 2.5 in the MID-TECH user guide to view and enter these values).

The calibration is conducted with the vehicle **STOPPED** and the main carrier pump **NOT** running. To safeguard against back flushing and siphoning, **SHUT OFF** the feed line valves at the water tank.

NOTE: Thoroughly flush all injection lines and fill with clean water before performing calibration procedure.

A. Make sure all chemical containers are **filled** with fresh, clean water, and they are connected to the proper injection pumps. Turn all booms **OFF**.

B. Set the RS 6000 control console switches as follows:

Master Switch	OFF
Rotary Selector	AUTO

C. Set the TASC control console switches as follows:

Power	ON
Mode Selector	OPERATE
Display Selector	CHEMICALS,CHEM, APPLIED
Pump Switch #1	CENTER, ON POSITION

The accumulated volume for pump #1 will be displayed.

D. Use the **INC/DEC** switch to reset the display to zero. Select **SET-UP** with the Mode Selector switch. The current pump calibration number is displayed. Now go back to the pump and perform the flush operation.

E. Install calibration hose on the quick disconnect on the calibration valve. Turn the handle on the calibration valve so the arrow on the handle points towards the quick disconnect.

F. Open the cover on pump #1 and press and hold the Calibrate Button, (The top button on upper left corner of chemical pump), (or install magnet). Allow the pump to run until satisfied the lines are flushed and filled with liquid. Release the button.

G. Return to the control console and select **OPERATE** with the Mode Selector switch. Use the **INC/DEC** switch to zero the accumulated volume for pump #1 and again select **SET- UP** with the Mode Selector switch. Now go back to the pump and perform the test.

Note: Finish with the same amount of water in the calibration tube as you started with.

- H. Be sure the supply tank for the pump being calibrated contains more than enough material to conduct the test. Direct the discharge line from the injection pump into the graduated container.
- I. Press and hold the Calibrate Button, (or install magnet), and allow the pump to discharge into the calibration container. When enough material has been pumped, release the button. Verify the amount of liquid in the calibration container as observed on the marks on the side of the container (ie. 56 oz)
- J. Return to the console. Select the **OPERATE** Mode. The number displayed will be the "Indicated" Ounces from Pump # 1. If the console reading agrees with the calibration container the pump is calibrated. If the console reading is incorrect, calculate the new calibration number. For instance, if the Indicated Ounces reads 53 instead of the actual 56 (which we collected), then we would divide the Actual Ounces by the Indicated Ounces and multiply the Actual Ounces collected by the old PC# to determine the new PC#.

$$\text{Actual Oz./Indicated Oz.} \times \text{Old PC\#} = \text{New PC\#}$$

If the Indicated Ounces is less than the Actual Ounces collected, the Cal# will increase.

$$\text{Example: } 56/53 \times 145.0 = 153.2, \text{ the New PC\#}$$

- K. To change the Pump Calibration Number, return to the **SET - UP** Mode and view the old Pump Calibration Number (145.0 for example).
- L. Use the **INC/DEC** switch to increase the PC# from 145.0 to 153.2.
- M. Set the Mode Select switch back to **OPERATE** and the accumulated ounces will again be displayed. The console recalculates the ounces accumulated and should now show the amount actually collected (56 in our example). If the displayed value of accumulated ounces is off by a significant amount, recheck the calculations making sure the math is correct.
- N. Turn **OFF** pump #1. Turn the handle on the calibration valve so the arrow on the handle points to the rear of the calibration valve.

CALIBRATION TIPS

Calibration should be done with Test Speed set at 10 mph, Calibration "C" width set at 120" (factory default), and the highest application rate to be used. Once this is complete then check at the low end by reducing test speed or width. If there is a difference between the two tests then one of the following could be the cause:

- The chemical is too thick to completely fill the pump tube at the higher rates.
- The pump tube is damaged and needs replacement.
- There is an air leak on the suction side of the chemical pump.

Note: Each of the tests should be run more than once for accuracy.

Use only the clear calibration hoses supplied with the machine, they allow you to see any air bubbles that could cause inaccurate results.

DISTANCE CALIBRATION, GROUND SPEED SENSOR

It is important to field calibrate the distance sensor to insure optimum accuracy! The distance calibration must be periodically checked. This is especially important if the sensor has come loose or been repositioned (Radar Sensor), or if the tires have been changed (Wheel and Speedometer Sensor).

Use the following initial calibration settings to get started. For the radar this number will be pretty close. For the wheel speed sensor and the speedometer sensor the adjustment to this initial calibration number may be very large, depending on the configuration of the vehicle.

Dj RADAR – 1000; MID-TECH COMPACT RADAR – 779; SPEEDOMETER SENSOR – 3500

- A. Set the TASC control console to the following settings:

Power	ON
Mode Selector	SET-UP
Display Selector	DISTANCE

The display now shows the current distance calibration value.

- B. Use the **INC/DEC** switch to select the initial distance calibration value suggested. You are now ready to perform the distance calibration.

DISTANCE CALIBRATION PROCEDURE

NOTE: All pump and boom switches should remain OFF during the entire procedure.

- A. Fill the main tank 1/2 full of water, to approximate actual load conditions. This minimizes the effect on the radar mounting angle and/or actual working diameter of the tires as the main tank empties.
- B. Measure out a known distance of 800-1200 ft. or more in a field or roadway. Make it an easy place to maneuver the vehicle. The longer the distance used for calibration, the more accurate the accumulated distance totals will be when spraying. Keeping the distance in even hundreds of feet will make the calculations easier.
- C. Drive the vehicle to the starting point of the distance range and stop.
- D. Turn the Display Selector to the **DISTANCE** position and the Mode Select switch to **SET-UP**. The console displays the current Distance Calibration Number. Record this number for future reference. As an example, assume this number is 1000.
- E. Return the Mode Select switch to **OPERATE** and check to see that the accumulated distance is set at zero. If not, reset it to zero using the **INC/DEC** switch.
- F. Start driving. Drive the vehicle at a speed of between 5 and 10 mph. The distance will start to accumulate in the display.
- G. Stop the vehicle at the end marker. The display shows the accumulated distance. Compare this distance to the actual measured distance, to determine how much of a correction is necessary. For example, if an accumulated distance of 792 ft. is shown after driving over a 800 ft. range, the error in the distance calibration is 1.0%.
- H. Calculate the new Distance Calibration Number using the following formula:

$$(\text{Measured distance} / \text{Accumulated distance}) \times \text{Old DC\#} = \text{New DC\#}$$

If the accumulated distance is less than the measured distance the new Cal# will be larger.

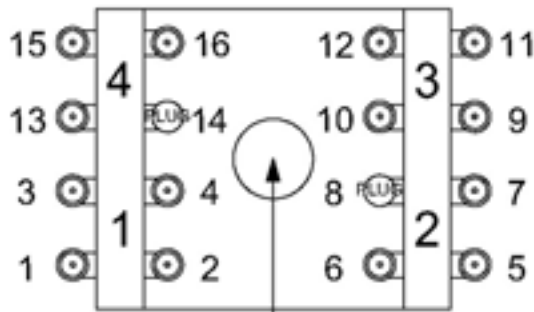
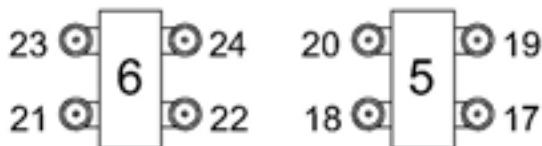
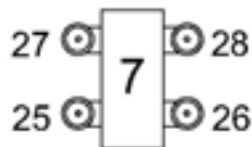
Example: $(800 / 792) \times 1000 = 1010$, the New DC#

NOTE: The same procedure is used, regardless of the type of distance sensor.

RECORD THE DISTANCE CALIBRATION NUMBER HERE:

NUTATING SPRAYHEAD SET UP

- Step 1. Disconnect power to nutating motor.
- Step 2. Rotate Nutating shaft until nozzles spray closest to truck
- Step 3. Set respective nozzles at distance from edge of truck bed.
- Step 4. Make minor adjustments to nozzles to insure full coverage.



Sprayhead Mounted with center of
nutating bearing 6' from the ground

C - CAM

Nozzle #	Distance
1	0"
2	6"
3	12"
4	18"
5	24"
6	33"
7	41"
8	Plug
9	52"
10	61"
11	70"
12	81"
13	92"
14	Plug
15	105"
16	124"

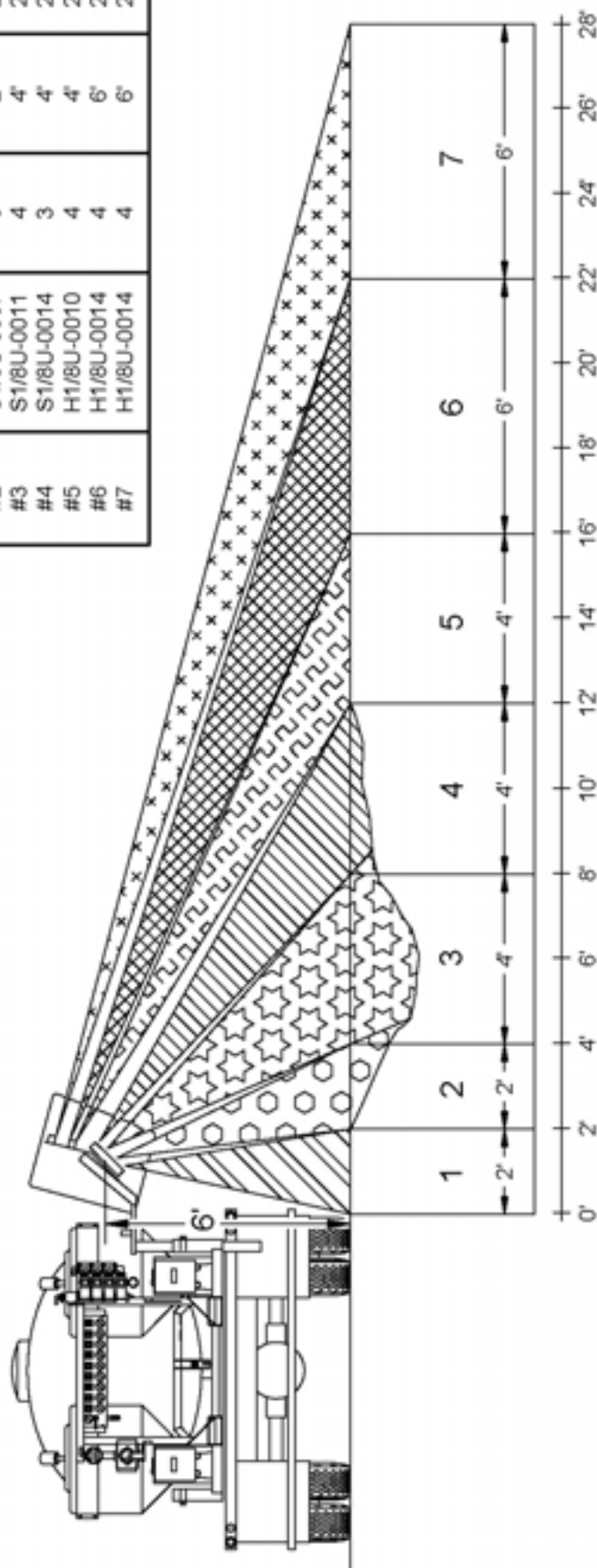
Remaining Nozzles are
Set to give full coverage

NORSTAR INDUSTRIES, INC.		2302 A St. S.E. Auburn, WA 98002		Tel: (253) 735-1881 Fax: (253) 735-2051	
TITLE: NUTATING SPRAYHEAD SET UP					
DRAWN BY: MRM	CHECKED BY:	SCALE: 1:2	PAGE: 1/1		
DATE CREATED: 7/12/94	DRAWING NUMBER: NSC-20108	DATE REVISED: 5/26/95			

NSC-20108-V2 NUTATING SPRAYHEAD SPRAY PATTERN

25 GPA @ 15 MPH
35 GPA @ 11 MPH
48 GPA @ 8 MPH
77 GPA @ 5 MPH

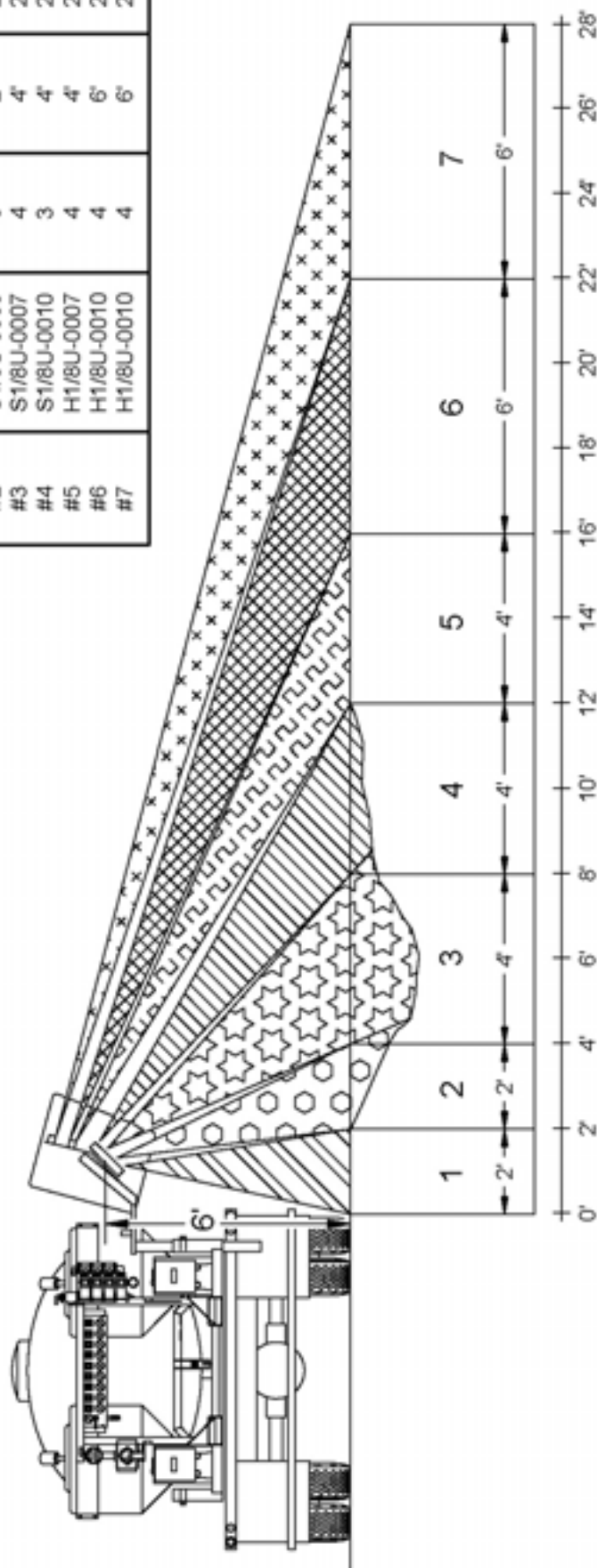
CAM C				
35 GPA @ 11 MPH - 28' WIDTH				
SPRAY SECTION	NOZZLE	QTY	WIDTH	PRESSURE
#1	S1/8U-0006	4	2'	20 PSI
#2	S1/8U-0007	3	2'	20 PSI
#3	S1/8U-0011	4	4'	20 PSI
#4	S1/8U-0014	3	4'	20 PSI
#5	H1/8U-0010	4	4'	25 PSI
#6	H1/8U-0014	4	6'	25 PSI
#7	H1/8U-0014	4	6'	25 PSI



NORSTAR EQUIPMENT, INC.		2302 A St. S.E. Auburn, WA 98002		Tel: (253) 735-1881 Fax: (253) 735-2051	
TITLE 35 GPA Nutating Sprayhead Pattern					
DRAWN BY T. Bannwarth		CHECKED BY		SCALE 1:45	PAGE 1/1
DATE CREATED 12/18/2001		DRAWING NUMBER 7-351128-SKID		DATE REVISED	

NSC-20108-V2 NUTATING SPRAYHEAD SPRAY PATTERN

18 GPA @ 15 MPH
25 GPA @ 11 MPH
34 GPA @ 8 MPH
55 GPA @ 5 MPH

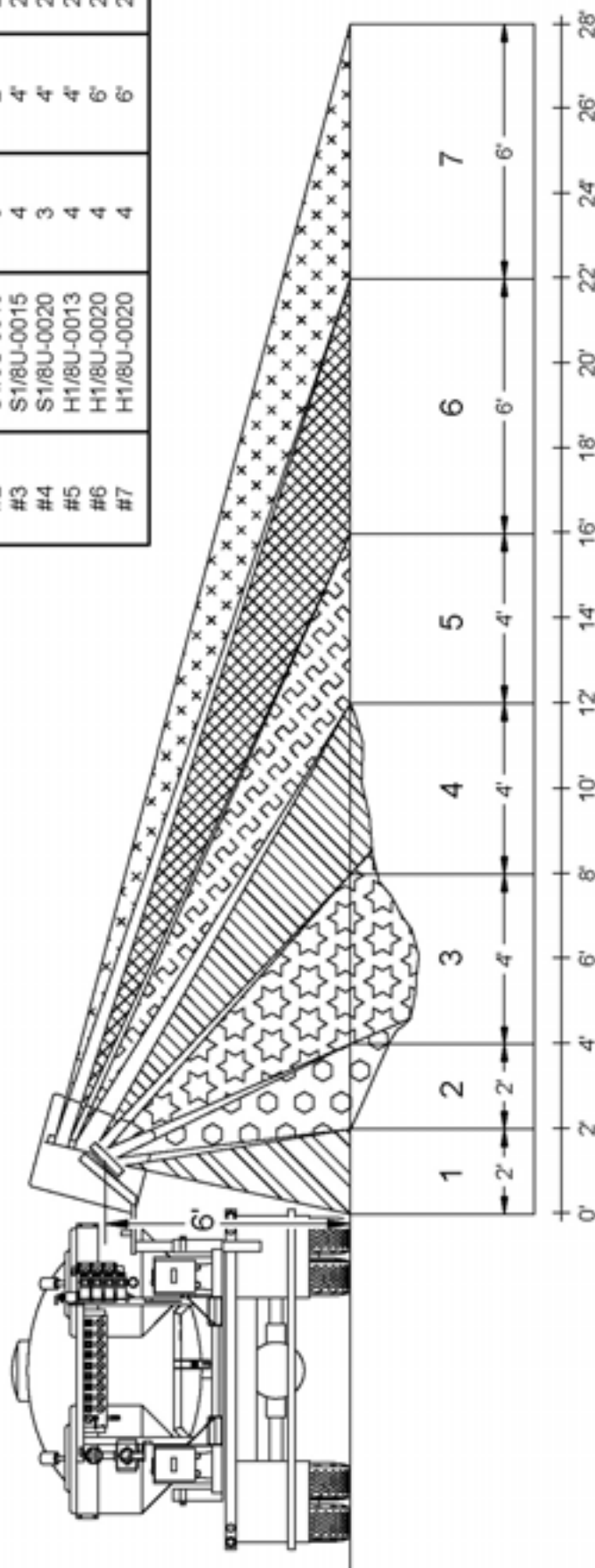


CAM C				
25 GPA @ 11 MPH - 28' WIDTH				
SPRAY SECTION	NOZZLE	QTY	WIDTH	PRESSURE
#1	S1/8U-0004	4	2'	20 PSI
#2	S1/8U-0005	3	2'	20 PSI
#3	S1/8U-0007	4	4'	20 PSI
#4	S1/8U-0010	3	4'	20 PSI
#5	H1/8U-0007	4	4'	25 PSI
#6	H1/8U-0010	4	6'	25 PSI
#7	H1/8U-0010	4	6'	25 PSI

NORSTAR 2302 A St. S.E. Auburn, WA 98602 Tel: (253) 735-1881 Fax: (253) 735-2051	
TITLE 25 GPA Nutating Sprayhead Pattern	
DRAWN BY T. Bannwarth	SCALE 1:45
DATE CREATED 12/18/2001	PAGE 1/1
7-251128-SKID	

NSC-20108-V2 NUTATING SPRAYHEAD SPRAY PATTERN

36 GPA @ 15 MPH
50 GPA @ 11 MPH
68 GPA @ 8 MPH
110 GPA @ 5 MPH



CAM C				
50 GPA @ 11 MPH - 28' WIDTH				
SPRAY SECTION	NOZZLE	QTY	WIDTH	PRESSURE
#1	S1/8U-0008	4	2'	20 PSI
#2	S1/8U-0010	3	2'	20 PSI
#3	S1/8U-0015	4	4'	20 PSI
#4	S1/8U-0020	3	4'	20 PSI
#5	H1/8U-0013	4	4'	25 PSI
#6	H1/8U-0020	4	6'	25 PSI
#7	H1/8U-0020	4	6'	25 PSI

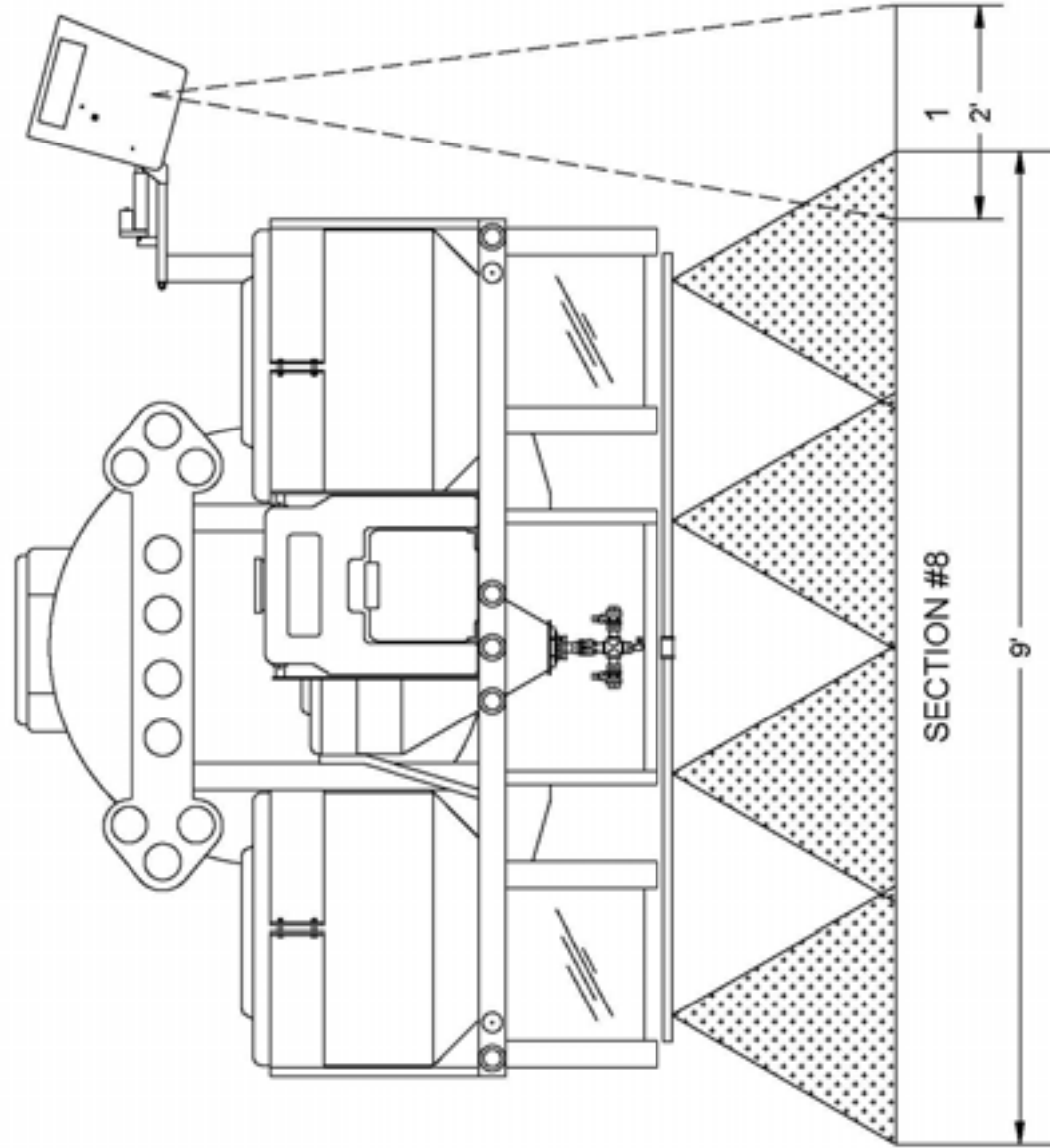
NORSTAR 2302 A St. S.E. Auburn, WA 98602 Tel: (253) 735-1881 Fax: (253) 735-2051	
TITLE 50 GPA Nutating Sprayhead Pattern	
DRAWN BY T. Bannwarth	SCALE 1:45
DATE CREATED 12/18/2001	PAGE 1/1
7-501128-SKID	

35 GPA @ 11 MPH - 9' WIDTH				
SPRAY SECTION	NOZZLE	QTY	WIDTH	PRESSURE
#8/#9	H1/4U-6520	4	9'	31 PSI

25 GPA @ 15 MPH
 35 GPA @ 11 MPH
 48 GPA @ 8 MPH
 77 GPA @ 5 MPH

25 GPA @ 11 MPH - 9' WIDTH				
SPRAY SECTION	NOZZLE	QTY	WIDTH	PRESSURE
#8/#9	H1/4U-6515	4	9'	30 PSI

18 GPA @ 15 MPH
 25 GPA @ 11 MPH
 34 GPA @ 8 MPH
 55 GPA @ 5 MPH



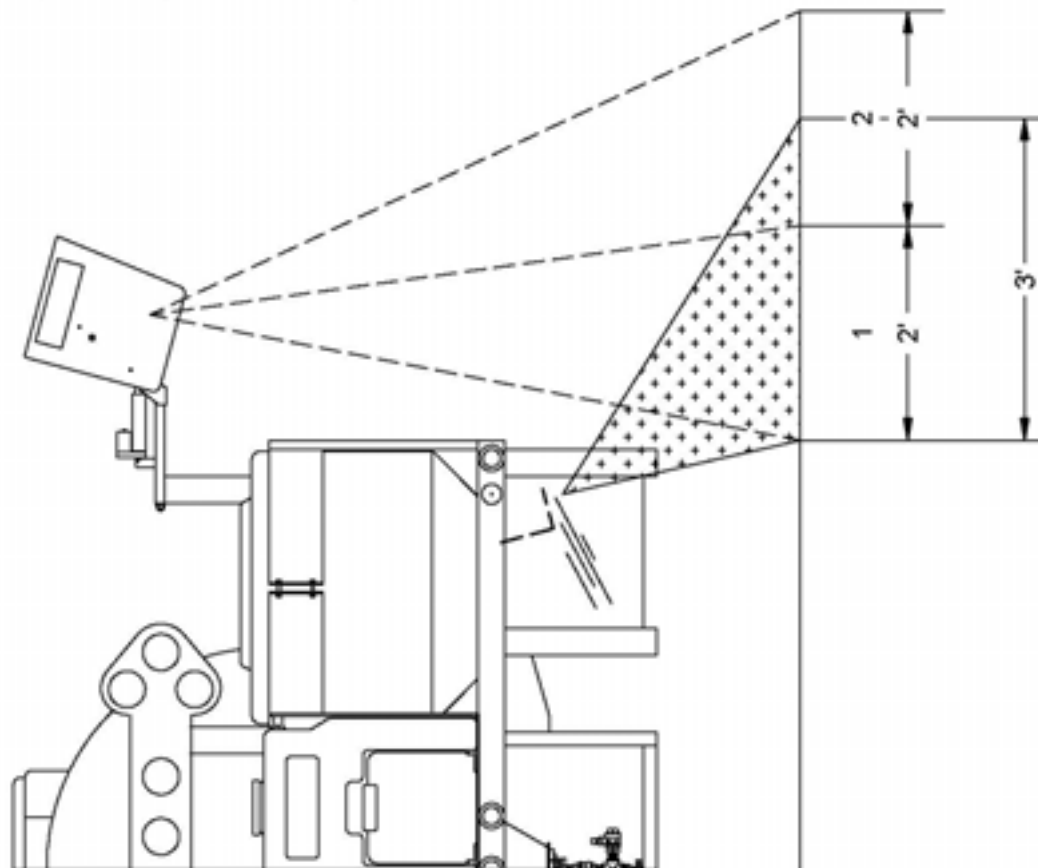
NORSTAR 2302 A St. S.E. Auburn, WA 98002 Tel: (253) 735-1881 Fax: (253) 735-2051		TITLE Rear Spray Bar Spray Pattern	
DRAWN BY T. Bannwarth	CHECKED BY	SCALE 1:20	PAGE 1/1
DATE CREATED 05/21/2001	DRAWING NUMBER NSC-90500-PTRN	DATE REVISION	

35 GPA @ 11 MPH - 3' WIDTH				
SPRAY SECTION	NOZZLE	QTY	WIDTH	PRESSURE
#8 or #9	H1/4U-5015	2	3'	25 PSI

25 GPA @ 15 MPH
 35 GPA @ 11 MPH
 48 GPA @ 8 MPH
 77 GPA @ 5 MPH

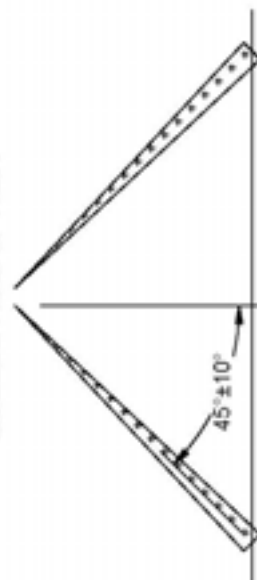
25 GPA @ 11 MPH - 3' WIDTH				
SPRAY SECTION	NOZZLE	QTY	WIDTH	PRESSURE
#8 or #9	H1/4U-5010	2	3'	30 PSI

19 GPA @ 15 MPH
 25 GPA @ 11 MPH
 36 GPA @ 8 MPH
 57 GPA @ 5 MPH



Section #8
 or
 Section #9

NOZZLE FRONT VIEW



DIRECTION OF TRAVEL

NORSTAR
 EQUIPMENT, INC.

2302 A St. S.E.
 Auburn, WA 98002
 Tel: (253) 735-1881
 Fax: (253) 735-2051

Drop Nozzle Spray Pattern

DESIGNED BY
 T. Bannwarth

CHECKED BY

SCALE

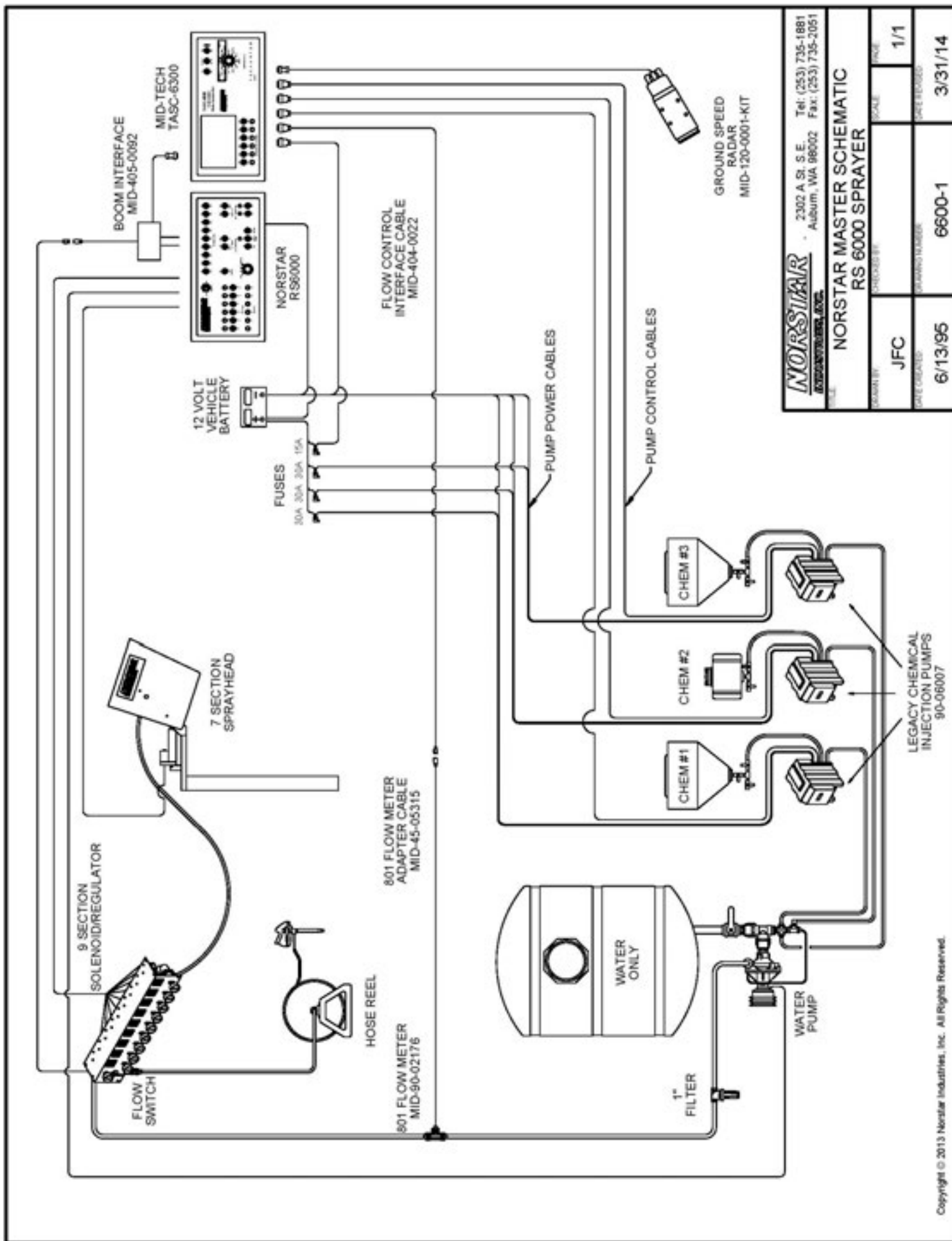
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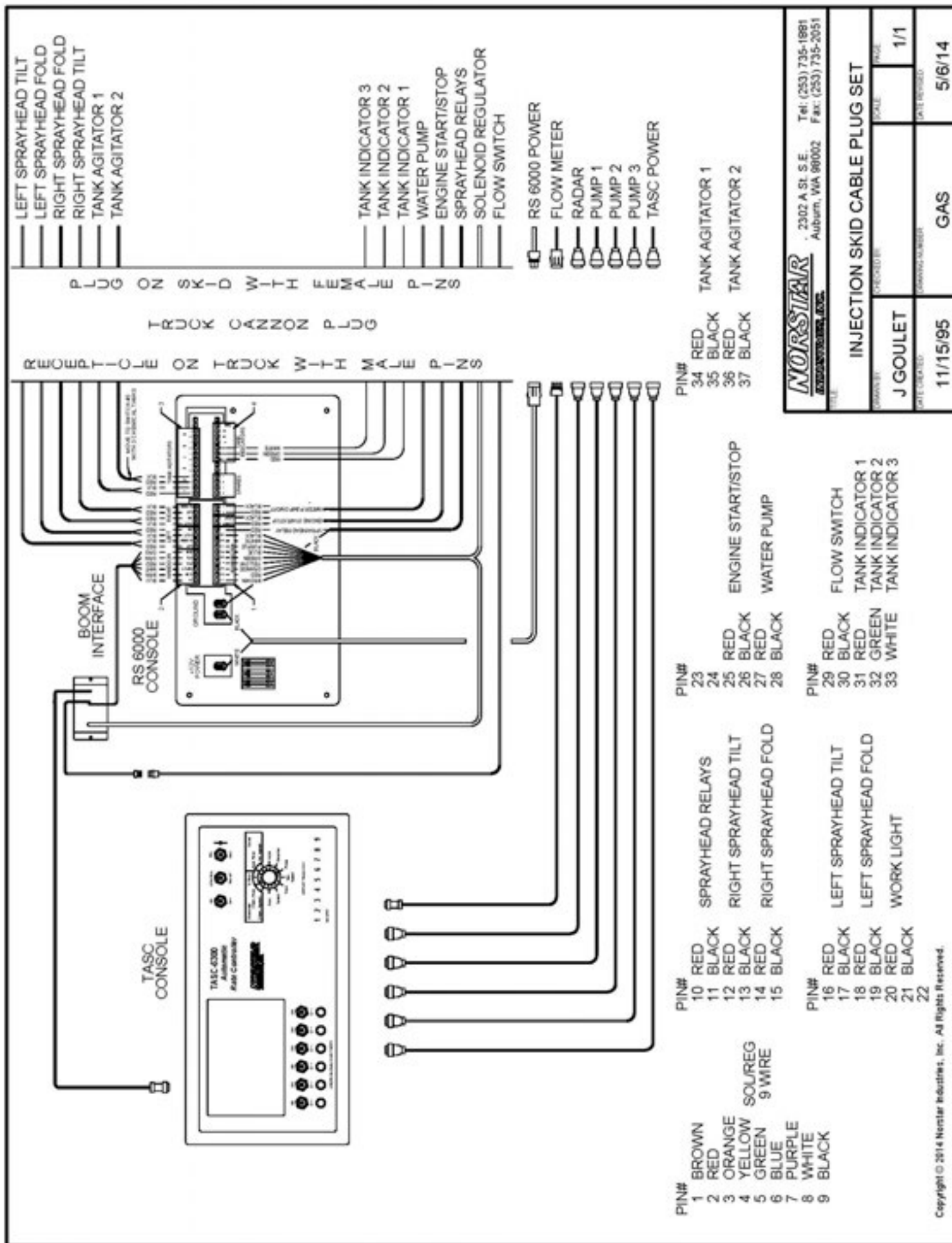
PAGE 1/1

DATE CREATED

05/21/2001

DRAWING NUMBER
 NSC-20320-PTRN



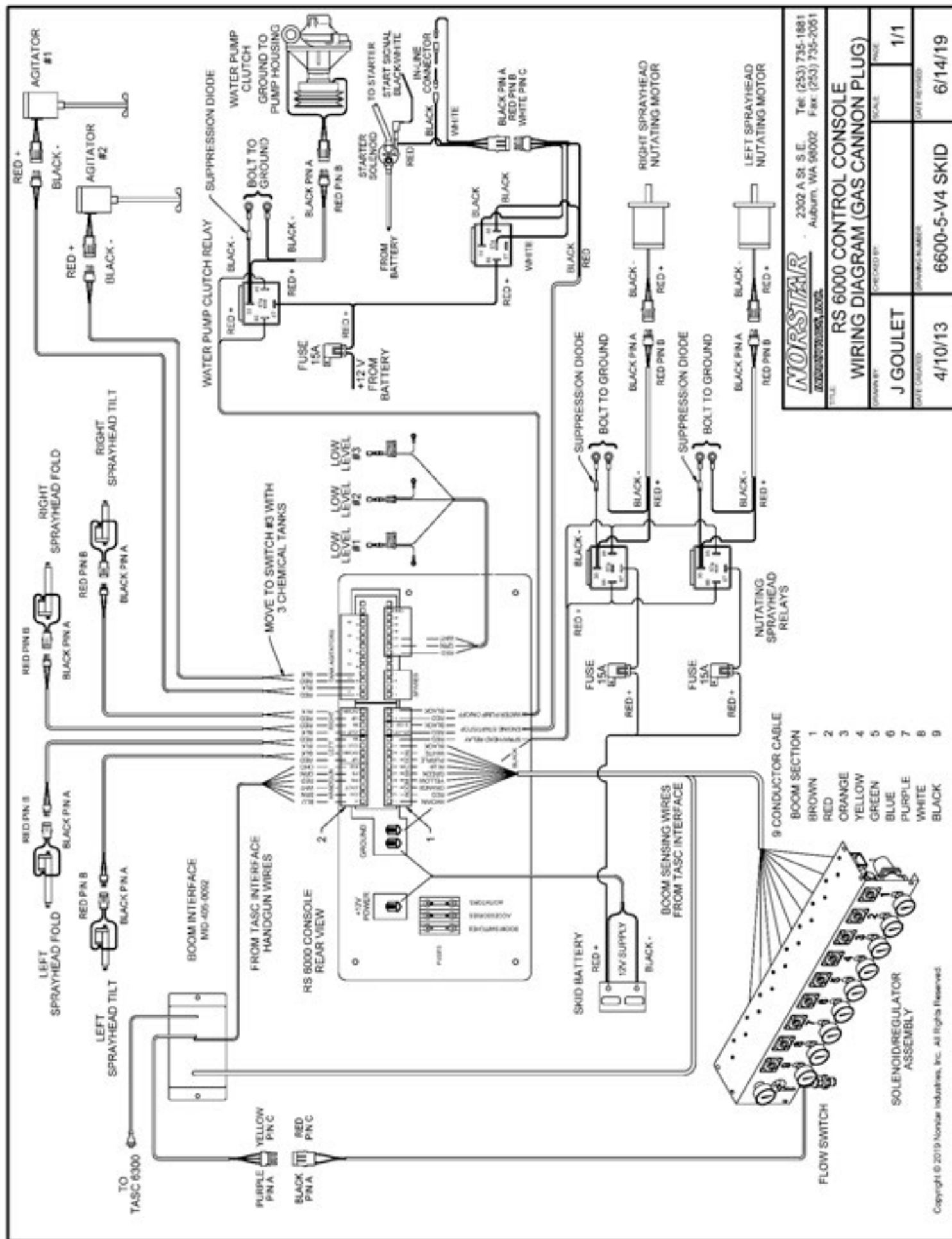


NORSTAR
INDUSTRIES, INC.

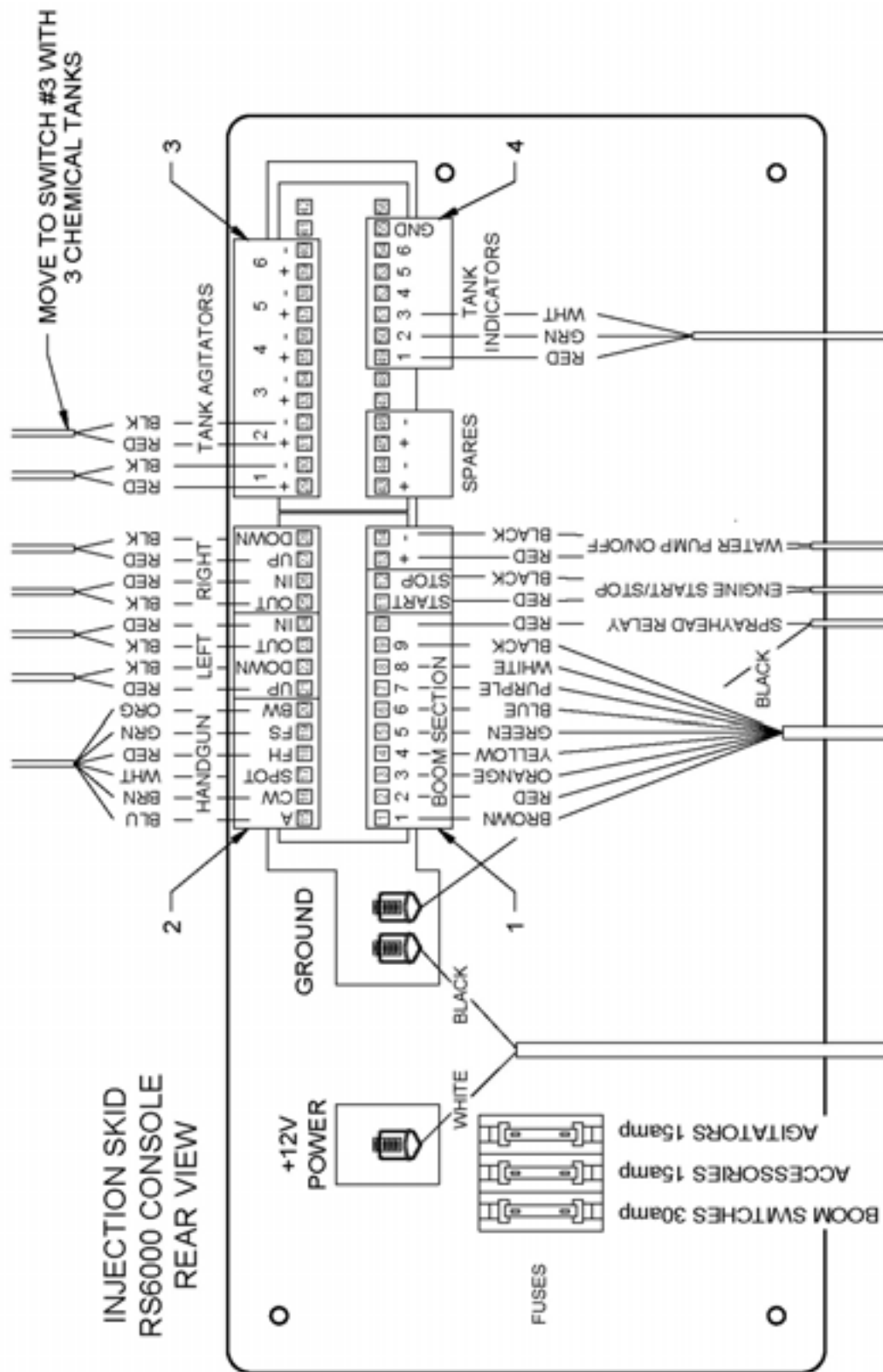
2302 A St. S.E.
Auburn, WA 98002
Tel: (253) 735-1881
Fax: (253) 735-2051

INJECTION SKID CABLE PLUG SET

DATE	CHECKED BY	SCALE	PAGE
11/15/95	J GOULET		1/1
DATE CREATED	DRAWING NUMBER	GAS	DATE REVISED
11/15/95		GAS	5/6/14



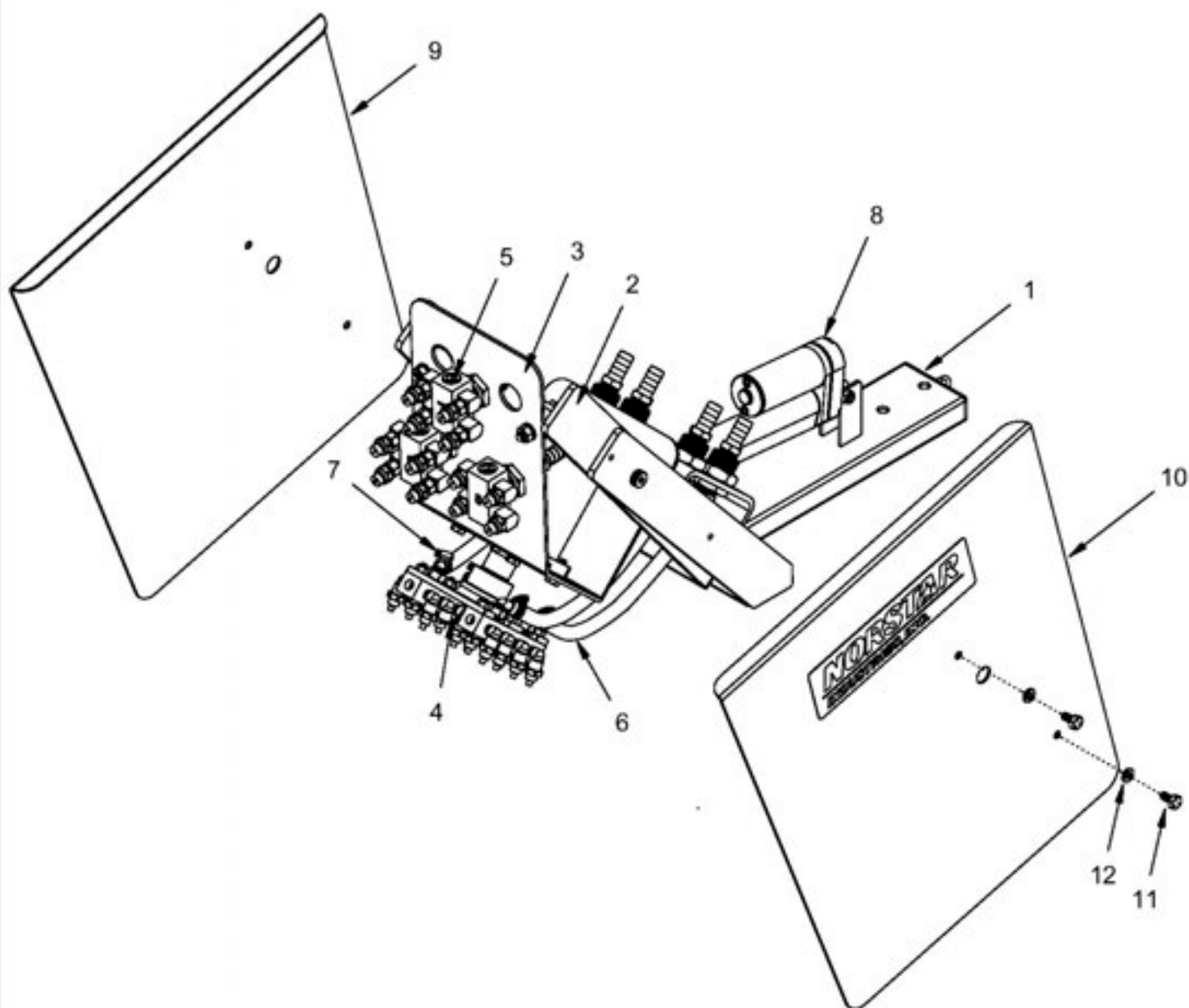
INJECTION SKID RS6000 CONSOLE REAR VIEW

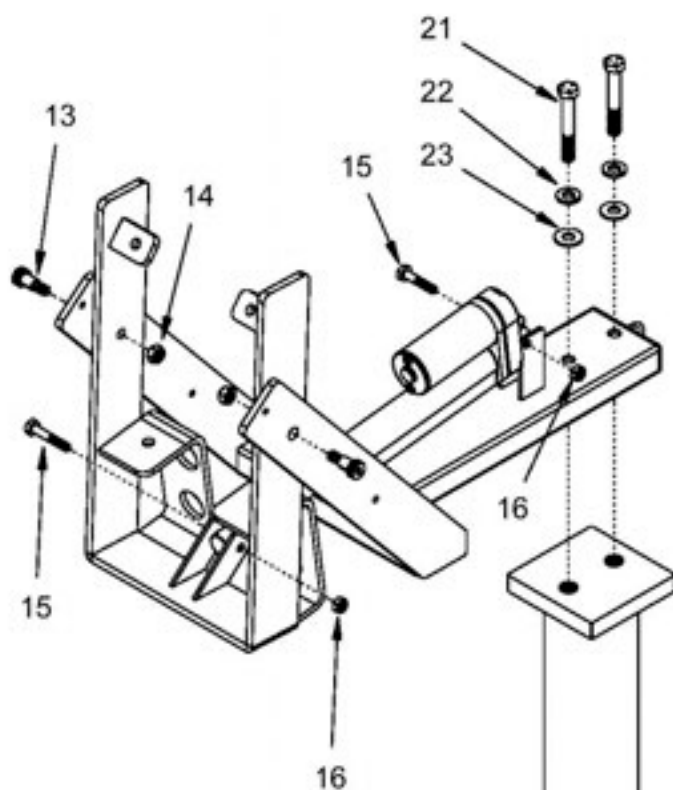


NORSTAR
AEROSPACE/INDUSTRIAL DIV.

2302 A St. S.E.
Auburn, WA 98002
Tel: (253) 735-1881
Fax: (253) 735-2051

TITLE			
RS 6000 CONTROL CONSOLE REAR PANEL (GAS CABLE PLUG SET)			
DESIGNED BY	CHURCHY	SCALE	1/1
DATE CREATED	11/15/95	DRAWING NUMBER	6600-4 SKID
		DATE REvised	8/20/12

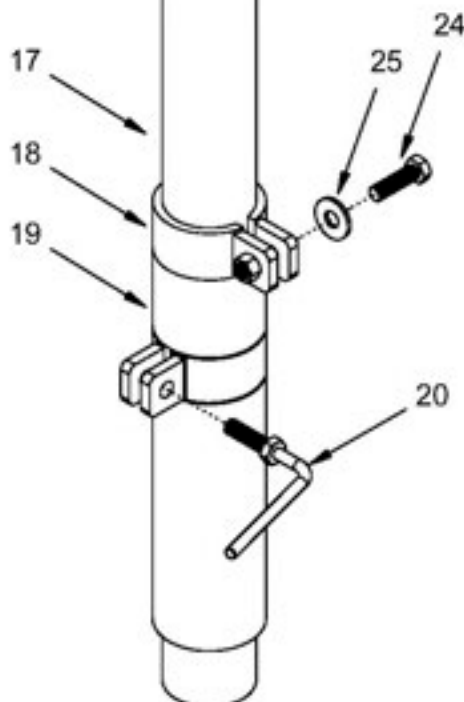




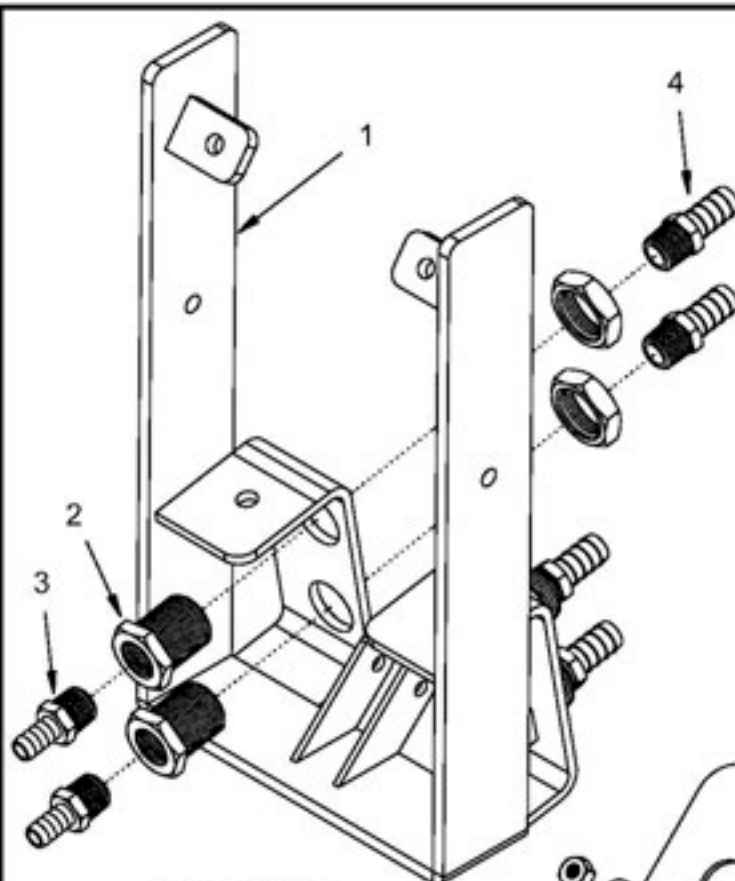
Item	Qty	Part Number	Description
1	1	FAB-2016	Sprayhead Mounting Bracket
2	1	ASM-3102	Nutating Subframe Assembly
3	1	ASM-3101	Nutating Drive Assembly
4	1	ASM-3080-V2	Nutating Plate Sub Assembly
5	3	ASM-3075	Upper Manifold Sub Assembly
6	3'	HSE-7230-06	Tygon Tubing
7	8	FAS-7655-04	Gear Clamp 1/4-5/8
8	1	SPR-6210	4" Linear Actuator
9	1	FAB-2013	Left Head Cover
10	1	FAB-2014	Right Head Cover
11	4	FAS-SHC-1/4-20X3/4-S	Hex Cap Screw
12	4	FAS-WLO-1/4-S	1/4" Lock Washer
13	2	FAS-SSX-3/8X7/16-SS	Socket Head Shoulder Bolt
14	2	FAS-NTL-5/16-18-S	Toplock Nut
15	2	FAS-SHC-1/4-20X1-1/2-S	Hex Cap Screw
16	2	FAS-NTL-1/4-20-S	Toplock Nut
17	1	FAB-2016-1	Sprayhead Mounting Post
18	1	FAB-2007	Sprayhead Post Clamp
19	1	FAB-2015	Sprayhead Mounting Socket
20	1	FAB-2141	Sprayhead Socket Handle
21	2	FAS-SHC-3/8-16X1 3/4-S	Hex Cap Screw
22	2	FAS-WLO-3/8-S	Lock Washer
23	2	FAS-WUS-5/16-S	USS Washer
24	1	FAS-SHC-1/2-20X1 3/4-S	Fine Thread Hex Cap Screw
25	1	FAS-WUS-7/16-S	USS Washer

NOTES:

1. Nozzle set sold separately
2. Hose kit to solenoid regulator assembly not shown for clarity
3. Items #2, #3 & #4, #5 sub assemblies shown on following pages.



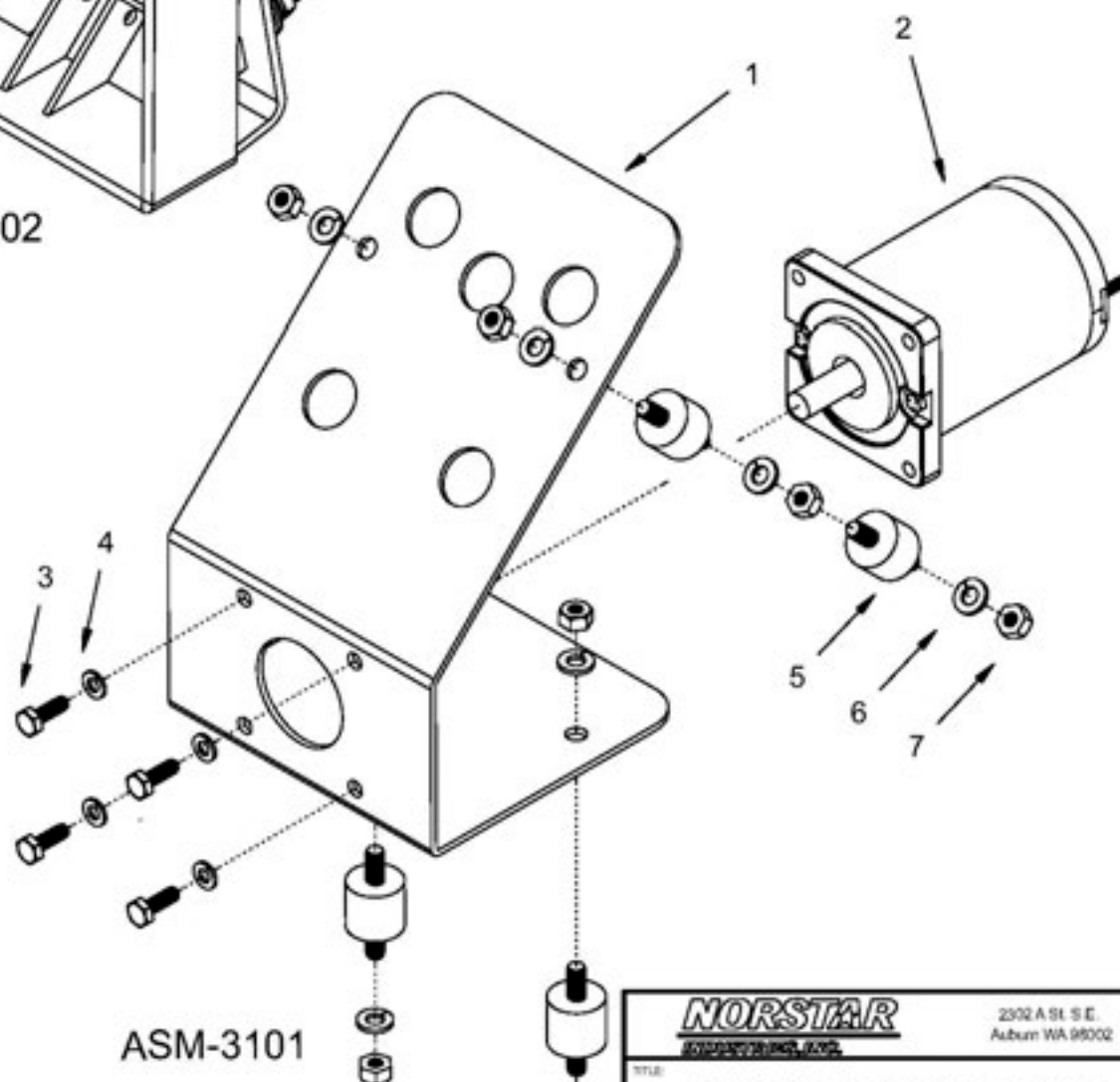
NORSTAR MANUFACTURING INC.		2302 A St. S.E. Auburn WA 98002	
TITLE: 7 SECTION NUTATING SPRAYHEAD			
DRAWN BY: J GOULET	CHECKED BY:	SCALE: 1:5	PAGE: 1/1
DATE CREATED: 12/12/02	DRAWING NUMBER: NSC-20108-V2	DATE REVISED:	



ASM-3102

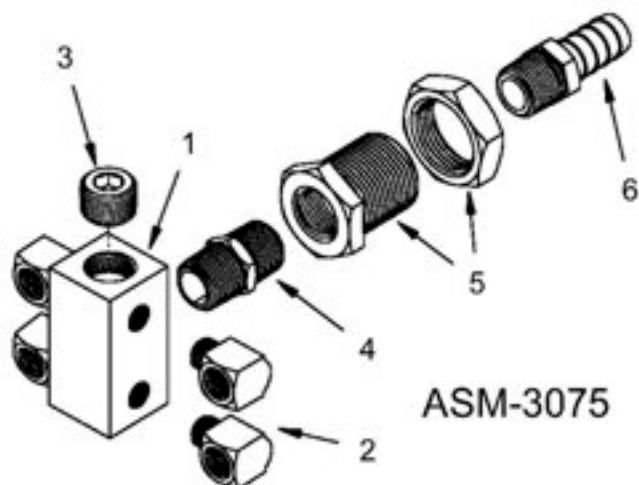
ASM-3102 Nutating Subframe Assembly			
Item	Qty	Part Number	Description
1	1	FAB-2012	Nutating Subframe Weldment
2	4	BRF-BHD-06FP	3/8" Brass Bulkhead Fitting
3	4	BRF-SBR-06BX06MP	3/8" Brass Hose Barb x 3/8" NPT
4	4	BRF-SBR-08BX06MP	1/2" Brass Hose Barb x 3/8" NPT

ASM-3101 Nutating Drive Assembly			
Item	Qty	Part Number	Description
1	1	FAB-2011	Nutating Motor Bracket
2	1	SPR-6160	Nutating Motor
3	4	FAS-SHC-1/4-20X3/4-S	1/4-20 X 3/4" Hex Cap Screw
4	4	FAS-WLO-1/4-S	1/4" Lock Washer
5	4	SPR-4754	5/16" Rubber Mount
6	8	FAS-WLO-5/16-S	5/16" Lock Washer
7	8	FAS-NSD-5/16-18-S	5/16-18 Hex Nut



ASM-3101

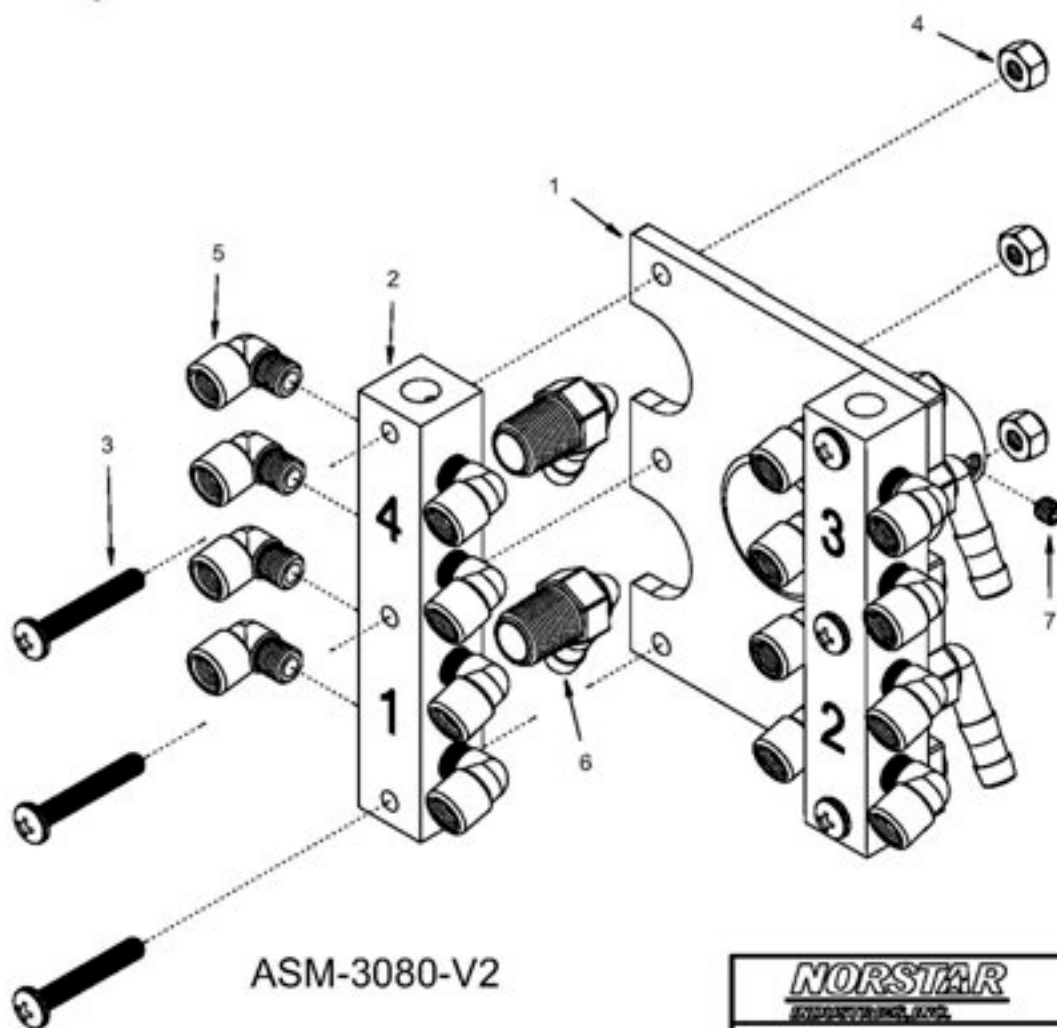
<u>NORSTAR</u> <u>EQUIPMENT, INC.</u>		2302 A ST. S.E. Auburn WA 98002	
TITLE: SPRAYHEAD SUB ASSEMBLIES			
DRAWN BY: J GOULET	CHECKED BY:	SCALE: 1:3	PAGE: 1/2
DATE CREATED: 12/2/02	DRAWING NUMBER:	DATE REVISED: 12/12/047	



ASM-3075

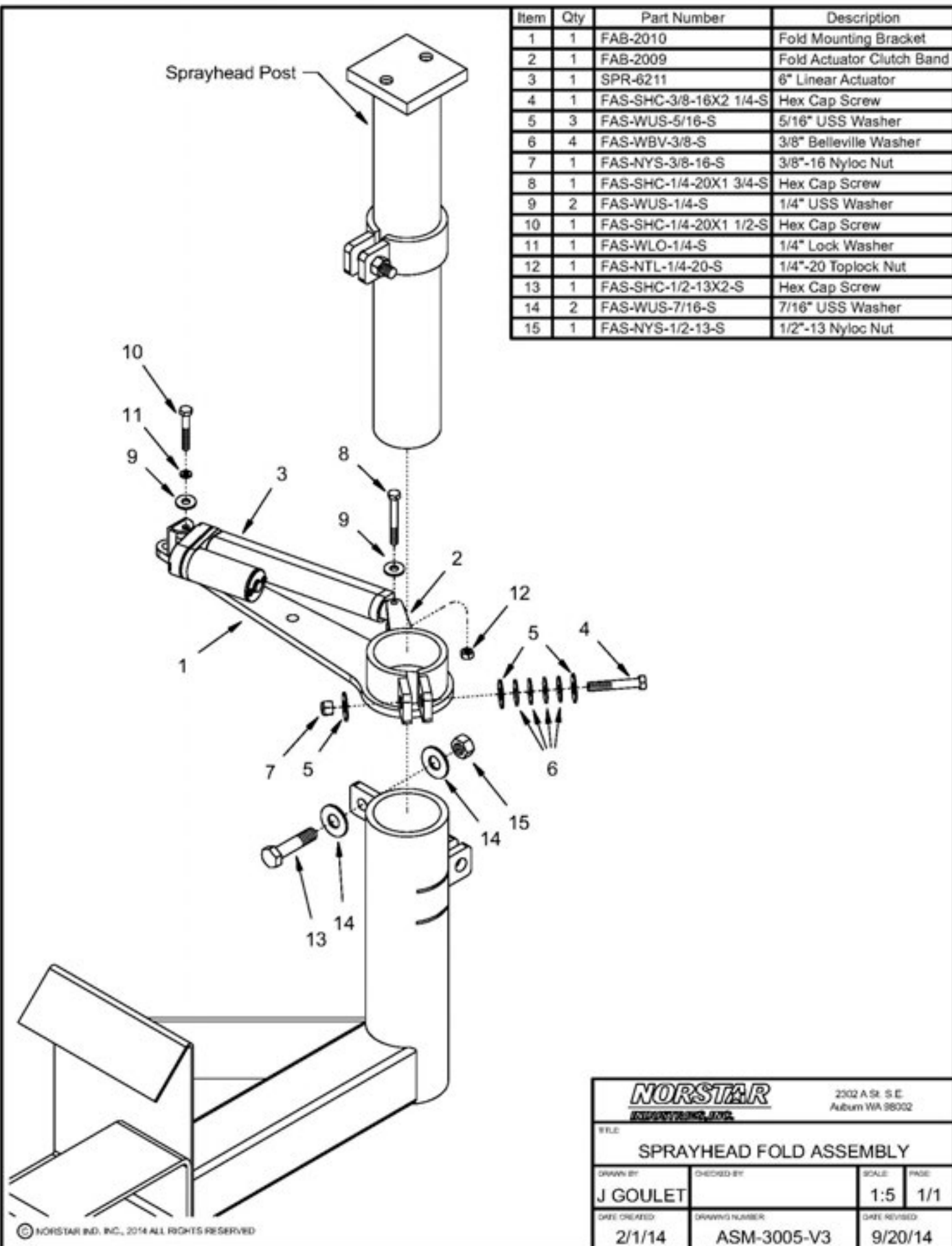
ASM-3075 Upper Manifold Sub Assembly			
Item	Qty	Part Number	Description
1	1	FAB-2265	Brass Nozzle Manifold
2	4	BRF-9SL-02P	1/8" 90° Street Elbow
3	1	BRF-HHP-06MP	3/8" Hollow Hex Plug
4	1	BRF-HXN-06MP	3/8" Hex Nipple
5	1	BRF-BHD-06FP	3/8" Bulkhead Fitting
6	1	BRF-SBR-08BX06MP	1/2" Hose Barb x 3/8" Male Pipe

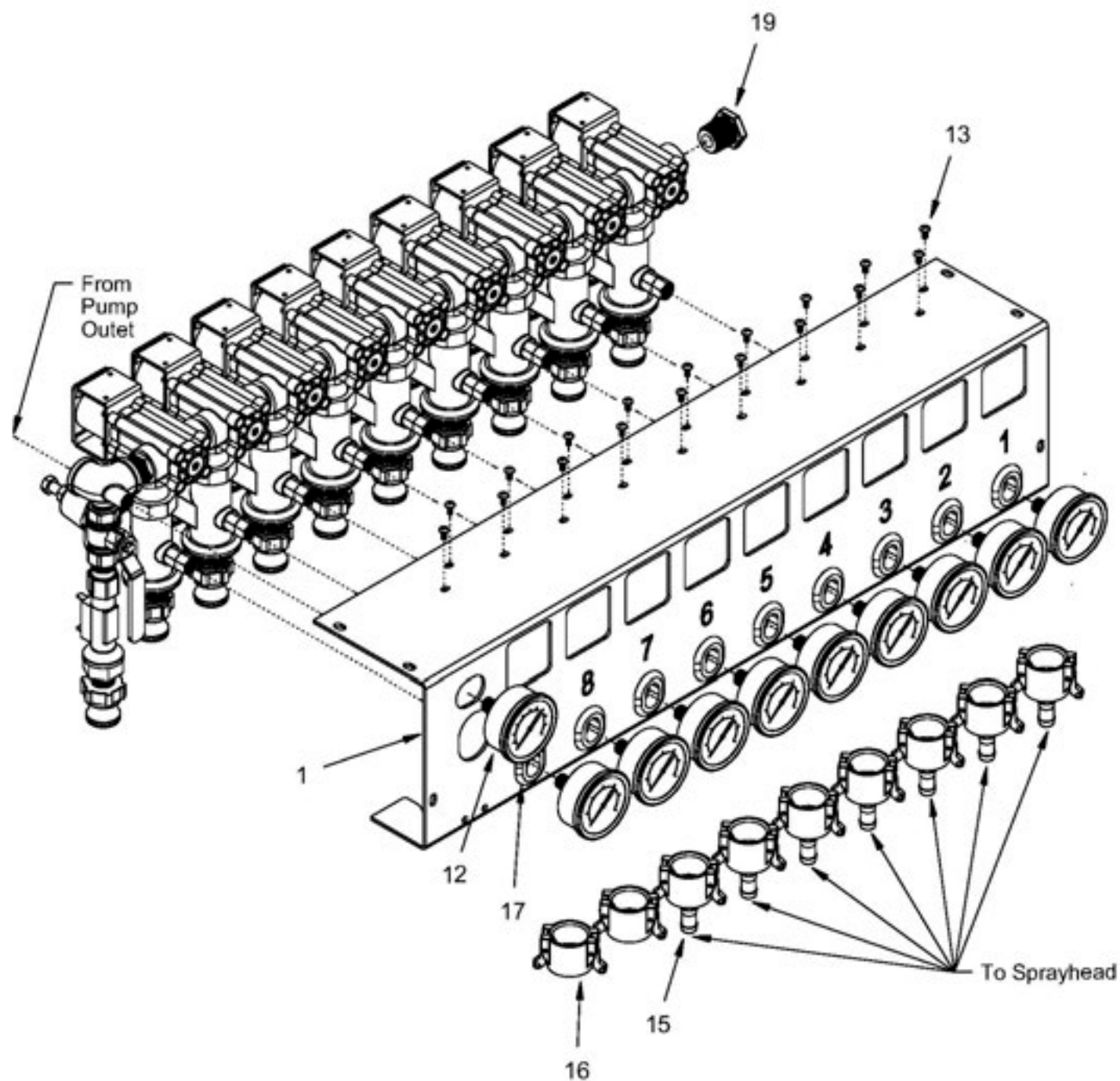
ASM-3080-V2 Nutating Plate Sub Assembly			
Item	Qty	Part Number	Description
1	1	ASM-3103	Nutating Bearing Cartridge
2	2	FAB-2265	Nutating Head Manifold
3	6	FAS-SPP-10-32X1-1/4-SS	Stainless Panhead Philips Screw
4	6	FAS-NYS-10-32-SS	Stainless Nyloc Nut
5	16	SPR-4250	1/8" Nylon Street Elbow
6	4	SPR-4255	3/8" Barb x 1/4" MPT Nylon Elbow
7	1	FAS-SSS-1/4-20X.25-SS	1/4" Stainless Steel Set Screw

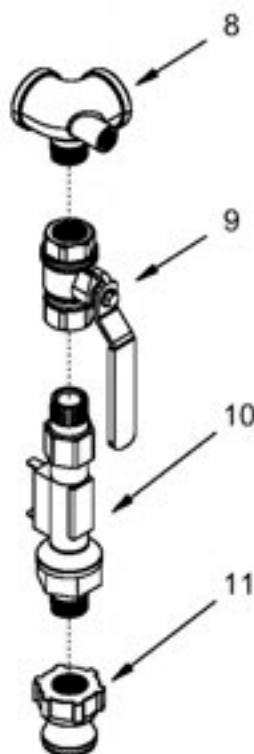


ASM-3080-V2

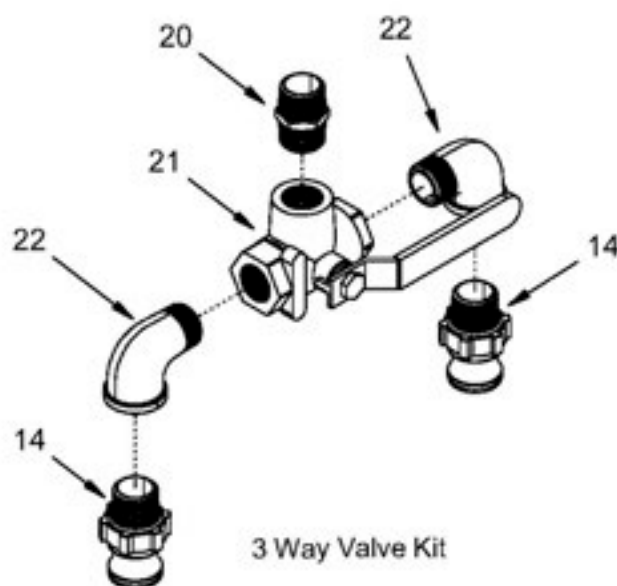
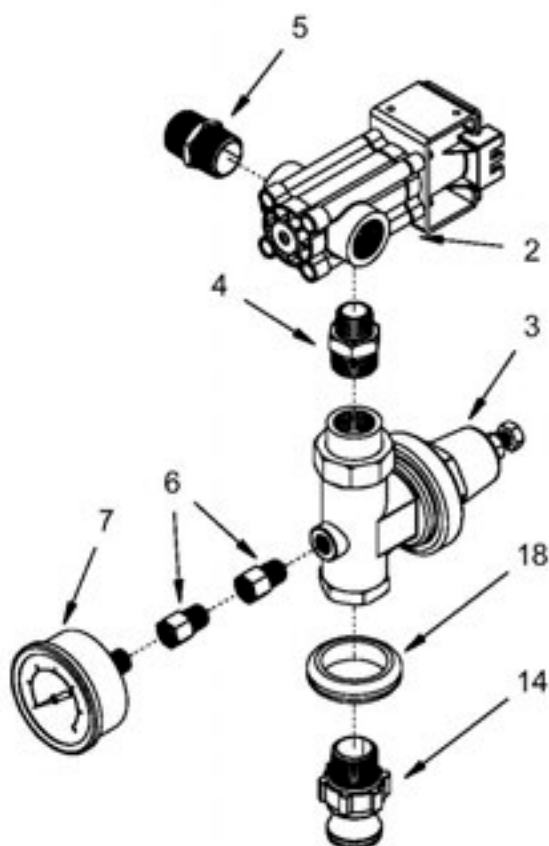
<u>NORSTAR</u> <u>EQUIPMENT, INC.</u>		2302 A ST. S.E. Auburn WA 98002	
TITLE: SPRAYHEAD SUB ASSEMBLIES			
DRAWN BY: J GOULET	CHECKED BY:	SCALE: 1:3	PAGE: 2/2
DATE CREATED: 12/2/02	DRAWING NUMBER:	DATE REVISED: 12/12/047	







Item	Qty	Part Number	Description
1	1	FAB-3037	9 Section Solenoid Bracket
2	9	SPS-AA144A-1-V1	144A Solenoid Valve
2A		SPS-AB144-1-V1-KIT	144A Solenoid Repair Kit (Not Shown)
3	9	SPR-5340-V1	3/4" Pressure Regulator
3A		SPR-5340-KIT	Repair Kit (Not Shown)
4	9	BRF-HXN-12MPX08MP	3/4" x 1/2" Brass Hex Nipple
5	9	PPF-HXN-12MP-SHORT	3/4" Poly Hex Nipple
6	18	BRF-ADP-04FPX04MP	1/4" x 1/4" Brass Adapter
7	9	SPR-4827	Liquid Filled Pressure Gauge 0-60 PSI
8	1	FAB-3029	Stainless Steel Inlet Fitting
9	1	LHA-8V08N	1/2" Brass Ball Valve
10	1	SPR-6520	Flow Sensor
11	1	PPF-MQD-08FP	3/4" Poly Male Quick Disconnect
12	1	SPR-4828	Liquid Filled Pressure Gauge 0-100 PSI
13	18	FAS-SRP-10-24X3/8-SS	Stainless Steel Round Head Screw
14	9/16	PPF-MQD-12MP	3/4" Poly Male Quick Disconnect
15	9/16	PPF-FQD-08B	1/2" Poly Female Quick Disconnect
16	2	PPF-FQD-08X	1/2" Poly Quick Disconnect Cap
17	9	MIS-9307K72	7/8" Grommet
18	9	MIS-9307K75	1 1/2" Grommet
19	1	PPF-HXP-12MP	3/4" Poly Hex Plug
20	7	BRF-HXN-12MP	3/4" Brass Hex Nipple
21	7	SPR-5201	3/4" 3-way Ball Valve
22	14	BRF-9SL-12P	3/4" Brass 90° Street Elbow
23	50'	HSE-7200-08	1/2" Bosflex Hose (Not Shown)
24	14	FAS-7655-06	Hose Clamp (Not Shown)



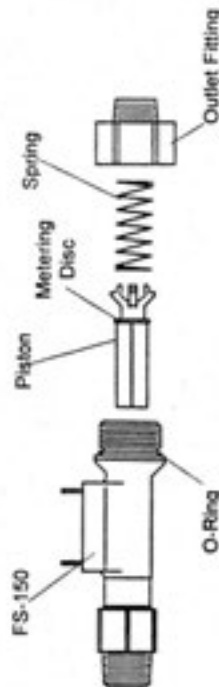
<i>NORSTAR</i> <i>HYDRA-SOLING, INC.</i>		2302 A St. S.E. Auburn WA 98002	
TITLE: 7 SECTION SOLENOID/REGULATOR ASSEMBLY			
DRAWN BY: J GOULET	CHECKED BY:	SCALE: 1:4	PAGE: 1/1
DATE CREATED: 3/31/13	DRAWING NUMBER: ASM-3093-V4-SKID	DATE REVISED:	

Maintenance . . .

Any foreign particle accumulation is easily cleared by removing the outlet fitting and piston/spring assembly and then cleaning the bore.

Caution: During this cleaning operation, take care not to dislodge the metering disc or damage the spring.

During reassembly, remember to clean the O-Ring of any debris that may have accumulated. Reinstall piston first, then spring, then outlet port (hand-tight, only). 150 Micron filtration is suggested.



Important Points!

Product must be maintained and installed in strict accordance with the National Electrical Code and GEMS product catalog and instruction bulletin. Failure to observe this warning could result in serious injuries or damages.

An appropriate explosion-proof enclosure or intrinsically safe interface device must be used for hazardous area applications involving such things as (but not limited to) ignitable mixtures, combustible dust and flammable materials.

Pressure and temperature limitations shown on individual catalog pages and drawings for the specified flow switches must not be exceeded. These pressures and temperatures take into consideration possible system surge pressures/temperatures and their frequencies.

Selection of materials for compatibility with the media is critical to the life and

operation of GEMS flow switches. Take care in the proper selection of materials of construction; particularly wetted materials.

Life expectancy of switch contacts varies with applications. Contact GEMS if life cycle testing is required.

Ambient temperature changes do affect switch set points, since the specific gravity of a liquid can vary with temperature.

Flow switches have been designed to resist shock and vibration; however, shock and vibration should be minimized.

Liquid media containing particulate and/or debris should be filtered to ensure proper operation of GEMS products.

Electrical entries and mounting points may require liquid/vapor sealing if located in an enclosed tank.

Flow switches must not be field repaired.

Physical damage sustained by the product may render it unserviceable.



Gems Sensors Inc.
One Cowles Road
Plainville, CT
06062 1198

tel 860.747.3000
fax 860.747.4244

P/N 133690
Rev. K

In-Line Flow Switches FS-150 Series

Sensors

Instruction Bulletin No. 133690

FS-150 Series Flow Switches operate reliably in any mounted attitude for which they are calibrated. Other attitudes will slightly alter actuation settings. Unless otherwise specified, units are calibrated in the horizontal position.

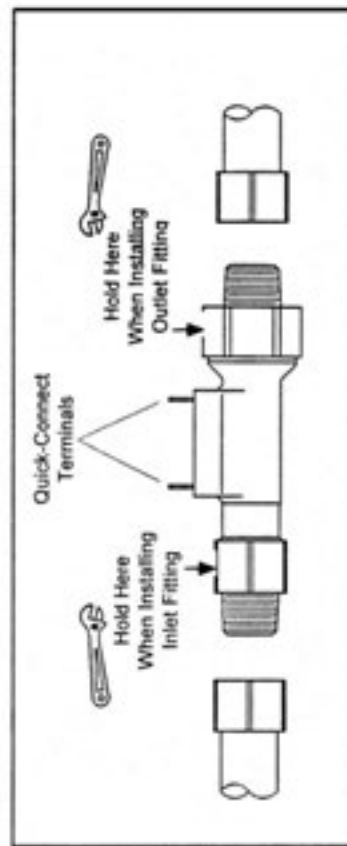
- Installation -

- WARNING -

The FS-150 is a plastic, NPT-threaded instrument. Over-tightening will result in port breakage!

All plastic NPT threads should be installed using a suitable thread sealant. (Teflon tape or Permatex "No More Leaks"). Sealant must be kept out of unit during installation. **Always hold the FS-150 by the wrench flats adjacent to the port being connected during installation, to insure sealing of NPT and prevent port breakage. (See Diagram Below)**

The outlet port on the FS-150 is threaded hand-tight to the body and sealed via an O-Ring. **Improper installation to a process can result in torquing of the union and cracking.** Install fittings or adapters onto flow switch using strap wrenches. One to two turns past hand-tight is adequate. After installing unit, electrical connection is made to 1/4" quick-connect terminals with crimp-type receptacle, supplied by customer.



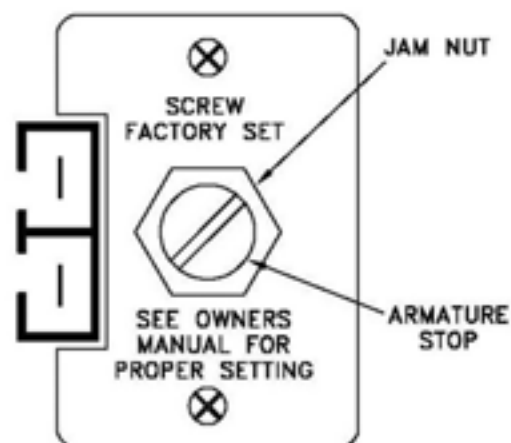
DIRECTIONS FOR ARMATURE STOP
ADJUSTMENTS FOR SOLENOID
OPERATED DIRECTOVALVE®
CONTROL VALVES.

144, 144H, 144A, 145, 145H, 146 VALVES

- 1) UNSCREW JAM NUT BY TURNING IT COUNTER-CLOCKWISE.
- 2) SCREW THE ARMATURE STOP DOWN CLOCKWISE UNTIL SOLID CONTACT IS MADE WITH THE ARMATURE. THIS CAN BE NOTICED BY OBSERVING SLIGHT MOVEMENT OF THE LOWER DIAPHRAGM PISTON.
- 3) BACK OUT ARMATURE STOP BY TURNING COUNTER-CLOCKWISE. (SEE TABLE AT RIGHT FOR NUMBER OF TURNS).
- 4) LOCK JAM NUT IN PLACE BY TURNING IT CLOCKWISE, WHILE HOLDING ARMATURE STOP IN POSITION.
- 5) STROKE CAN BE CHECKED BY MEASURING THE TRAVEL OF THE LOWER DIAPHRAGM PISTON. (SEE TABLE FOR STROKE LENGTH)

144-1-3, 144A-1-3, 144F-1-3 VALVES

- 1) UNSCREW JAM NUT BY TURNING IT COUNTER-CLOCKWISE.
- 2) UNSCREW ARMATURE STOP BY TURNING IT COUNTER-CLOCKWISE UNTIL IT STOPS.
- 3) PUSH UP ON LOWER DIAPHRAGM PISTON, BY INSERTING NAIL PUNCH INTO HOLE IN BOTTOM HOLDER, UNTIL YOU FEEL THE SEAT WASHER MAKE CONTACT WITH THE BODY SEATING SURFACE. (SEE SHEET 2)
- 4) WHILE HOLDING THE LOWER DIAPHRAGM PISTON UP, TURN THE ARMATURE STOP CLOCKWISE UNTIL IT MAKES SOLID CONTACT WITH THE ARMATURE. (SEE SHEET 2)
- 5) BACK OUT ARMATURE STOP BY TURNING COUNTER-CLOCKWISE. (SEE TABLE AT RIGHT FOR NUMBER OF TURNS)
- 6) LOCK JAM NUT BY TURNING IT CLOCKWISE.



TYPICAL TOP VIEW OF 144, 144H, 144A, 144-1-3, 144A-1-3, 144F-1-3, 145, 145H AND 146 CONTROL VALVES.

VALVE No.	No. OF ARMATURE STOP TURNS	APPROX. STROKE LENGTH
144	2 1/2	1/8" (3.2 mm)
144H	1 1/2	5/64" (2 mm)
144A	2	7/64" (2.8 mm)
145	3 1/2	3/16" (4.8 mm)
145H	3	11/64" (4.4 mm)
146	5	1/4" (6.4 mm)
144-1-3	1/8	N/A
144A-1-3	1/8	N/A
144F-1-3	1/8	N/A

NOTE: 1 TURN OF THE ARMATURE STOP IS EQUAL TO 360° OF ROTATION.

TOOLS NEEDED FOR ADJUSTMENT

- 1) ADJUSTABLE WRENCH
- 2) FLAT HEAD SCREWDRIVER
- 3) NAIL PUNCH

DESCRIPTION:

ARMATURE STOP ADJUSTMENTS
FOR SOLENOID OPERATED
DIRECTOVALVE® CONTROL VALVES



Spraying Systems Co.®

Spray Nozzles and Accessories
P.O. Box 7900 - Wheaton, IL 60189-7900

Rev. No. 1

Ref.

Data Sheet No.

38370

SHEET OF

ITEM	PART NO.	DESCRIPTION
1	CP14933-SS	Screw, Stainless Steel (2 Req'd)
2	CP15168-IENP	Jam Nut, Steel, Electroless Nickel Plated
3	CP15168-I	Coil Cover, Steel, Nitrolec Finish
4	CP15161-IENP	Armature Slap, Steel, Electroless Nickel Plated
5	CP15163-NYB	Coil Assembly, Nylon Encapsulated (Black)
6	CP14927-3-I	Strap, Steel, Nitrolec Finish
7	CP15169-302SS	Washer, Type 302 Stainless Steel
8	CP15164-NYB	Upper Diaphragm Housing, Nylon, Glass Filled (Black)
9	CP15170-IENP	Armature, Steel, Electroless Nickel Plated
10**	CP15167-302SS	Spring, Type 302 Stainless Steel
11	CP14813-1-IENP	Retaining Ring, Steel, Electroless Nickel Plated
12*	CP36101-EPR	Diaphragm, EPDM Rubber (Standard) 2 Req'd
13	CP36101-VI	Diaphragm, Viton (Optional) 2 Req'd
14	CP14807-SS	Seal Washer Retainer, Stainless Steel
15	CP14802-EPR	Seal Washer, EPDM Rubber (Standard)
16	CP14802-VI	Seal Washer, Viton (Optional)
17	CP14811-SS	Spacer, Stainless Steel
18	CP14801-PP	Body, Polypropylene (Black) (NPT)
19	CP814801-PP	Body, Polypropylene (Black) (BSPT)
20	CP14812-SS	Stem, Stainless Steel
21	CP14806-SS	Washer, Stainless Steel
22	CP15162-SS	Lower Diaphragm Piston, Stainless Steel
23	CP15165-NYB	Lower Diaphragm Housing, Glass Filled Nylon (Black)
24	CP14819-SS	Screw, Stainless Steel (4 Req'd)
25	CP21737-NYB	Connecting Nipple, Nylon (Black) Use only For Multiple Units
26	15905	Coil Sub-Assembly (Contains Items 1-6)
27	No. AA144A-1(-VI)	One Unit DirectoValve, Complete (NPT threads) (Viton version optional)
28	No. AA144A-2(-VI)	Two Unit DirectoValve, Complete (NPT threads) (Viton version optional)
29	No. AA144A-3(-VI)	Three Unit DirectoValve, Complete (NPT threads) (Viton version optional)
30	No. AA8144A-1(-VI)	One Unit DirectoValve, Complete (BSPT threads) (Viton version optional)
31	No. AA8144A-2(-VI)	Two Unit DirectoValve, Complete (BSPT threads) (Viton version optional)
32	No. AA8144A-3(-VI)	Three Unit DirectoValve, Complete (BSPT threads) (Viton version optional)
33	PK-AB144A-1-KIT	Spare Parts Kit (Includes One Set of Items Marked With *)
34	PK-AB144A-1-VI-KIT	Spare Parts Kit (Includes One Set of Items Marked With **)

DESCRIPTION:
AA(B)144A-1 SOLENOID OPERATED
DIRECTOVALVE**

Rev. No. 2

Ref.

PARTS LIST
PL144A
9-6 ECT OF

Spraying Systems Co.
Spray Nozzles and Accessories
P.O. Box 7900 - Wheaton, IL 60189-7900

Model 70XL

LEAD-FREE*

WILKINS

a  company

Pressure Reducing Valve with Integral By-pass (3/4" & 1")

*This product contains a weighted average lead content less than 0.25% for wetted surfaces.

□ Installation □ Testing □ Maintenance Instructions

REPAIR KIT INSTRUCTIONS

HOW TO MAKE REPAIRS:

(Shut off service before starting disassembly)

1. Open faucet on dwelling to remove line pressure.
2. Note distance that adjustment bolt protrudes from bell housing. Loosen locknut on adjustment bolt, then turn adjustment bolt out of bell housing to remove spring tension.
3. Unscrew bell housing counterclockwise and remove spring, spring disc and friction ring.
4. While holding diaphragm, unscrew diaphragm bolt counterclockwise and remove bolt, diaphragm disc and diaphragm.
5. Remove cartridge counterclockwise. Use a 1-1/8" socket for the 3/4" and a 1-3/8" socket for the 1". Make sure cartridge gasket is removed from the body.

TO REASSEMBLE:

1. While disassembled, open inlet of water service to flush out valve body and service line of debris.
2. Lubricate o-ring on replacement cartridge then thread into body clockwise.
3. Replace diaphragm, diaphragm disc and diaphragm bolt (it is necessary to hold diaphragm while tightening diaphragm bolt).
4. Replace friction ring, spring, spring disc and bell housing. Tighten bell housing onto body by threading clockwise.
5. Turn adjustment bolt into bell housing to old setting.
6. Enter dwelling and turn on several faucets.
7. Turn on water service. Let water run for several seconds then turn off faucets in dwelling.
8. Adjust regulator to desired pressure by turning adjustment bolt clockwise (into bell housing) to raise pressure or counterclockwise (out of bell housing) to lower pressure. **It is recommended a pressure gauge be installed down stream of the regulator to ensure pressure is reduced below 75 psi.** NOTE: When reducing pressure, open a down stream faucet to relieve pressure.
9. Tighten locknut when desired pressure is achieved.

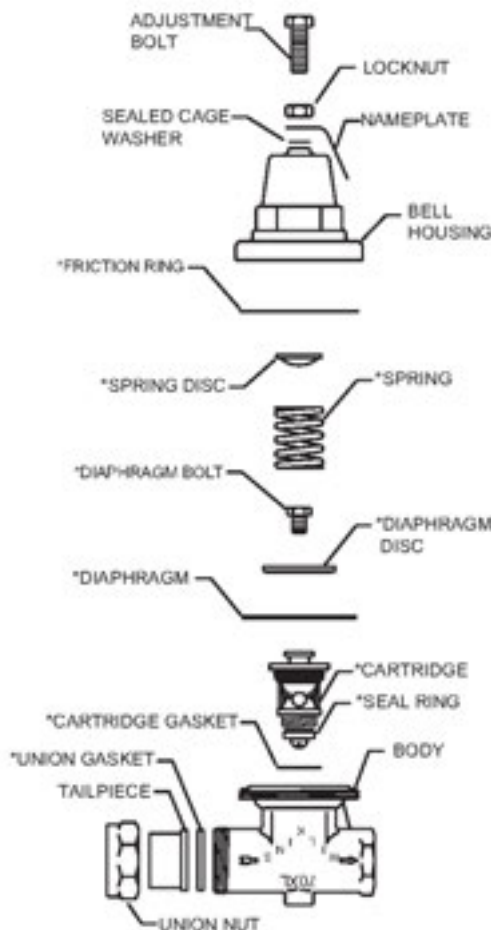
INSTALLATION INSTRUCTIONS

Install valve in line with arrow on valve body pointing in direction of flow. Before installing reducing valve, flush out line to remove loose dirt and scale which might damage seal ring and seat. All valves will be furnished with stock settings to reduce to 50 psi. To readjust reduced pressure, loosen outer locknut and turn adjustment bolt clockwise (into bell housing) to raise reduced pressure, or counterclockwise (out of bell housing) to lower reduced pressure.

NOTICE: Annual inspection and maintenance is required of all plumbing system components. To ensure proper performance and maximum life, this product must be subject to regular inspection, testing and cleaning.

WARRANTY: WILKINS Valves are guaranteed against defects of material or workmanship when used for the services recommended. If in any recommended service, a defect develops due to material or workmanship, and the device is returned, freight prepaid, to WILKINS within 12 months from date of purchase, it will be repaired or replaced free of charge. WILKINS' liability shall be limited to our agreement to repair or replace the valve only.

Proposition 65 Warning This product contains chemicals known to the State of California to cause cancer or birth defects or other reproductive harm.



*INDICATES PARTS SUPPLIED IN REPAIR KITS

Regulators in series: Where the desired pressure reduction is more than a 4 to 1 ratio (i.e. 200psi to 50psi), multiple regulators in series should be installed.

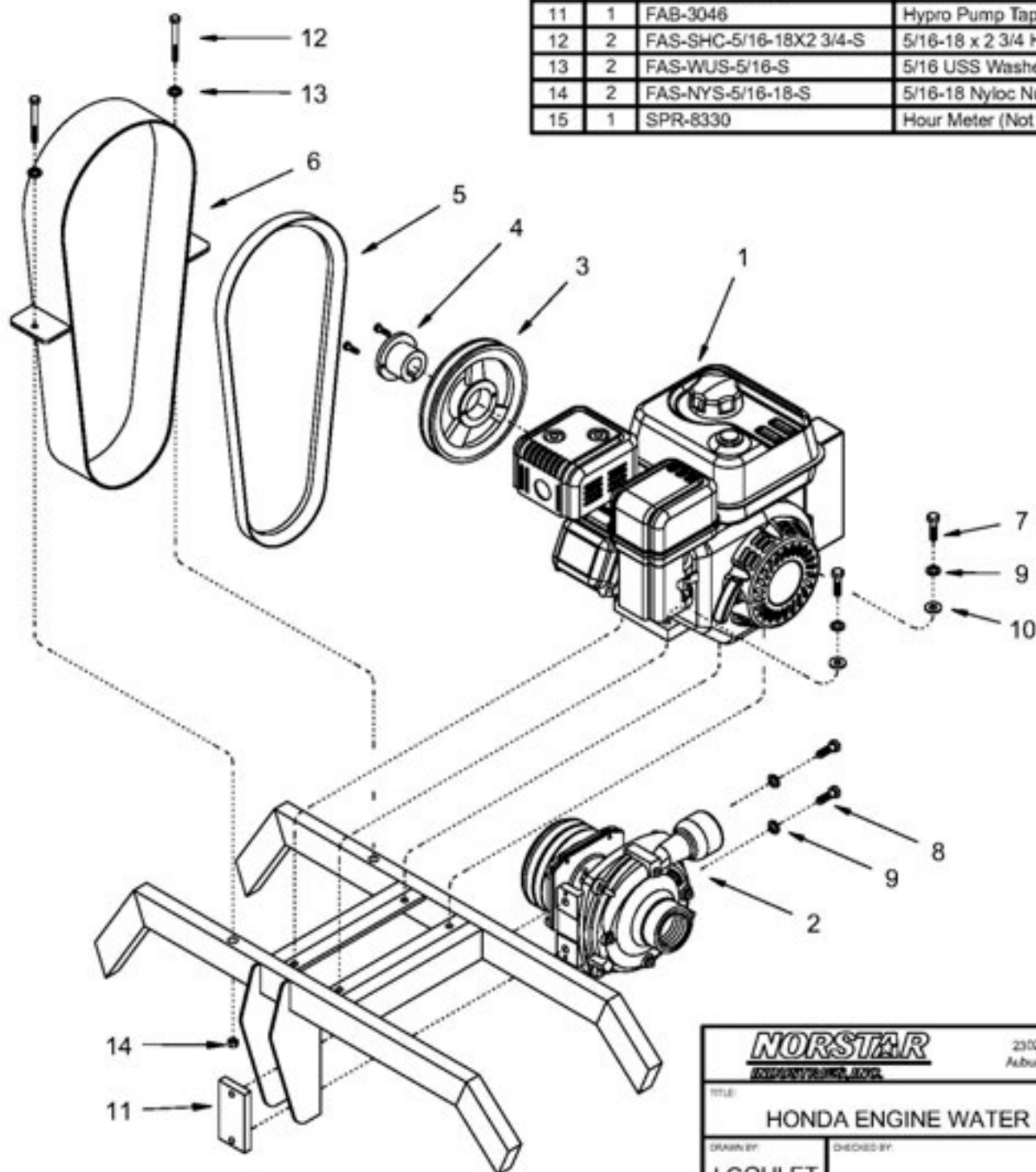
SEALED CAGE WARNING: Loosen lock washer at adjustment bolt slowly. Look for any trapped water pressure under the sealed cage washer. Relieve pressure before removing bell.

CAUTION: Anytime a reducing valve is adjusted, a pressure gauge must be used downstream to verify correct pressure setting. Do not bottom out adjustment bolt on bell housing. Valve may be installed in any position.

WILKINS
a  company

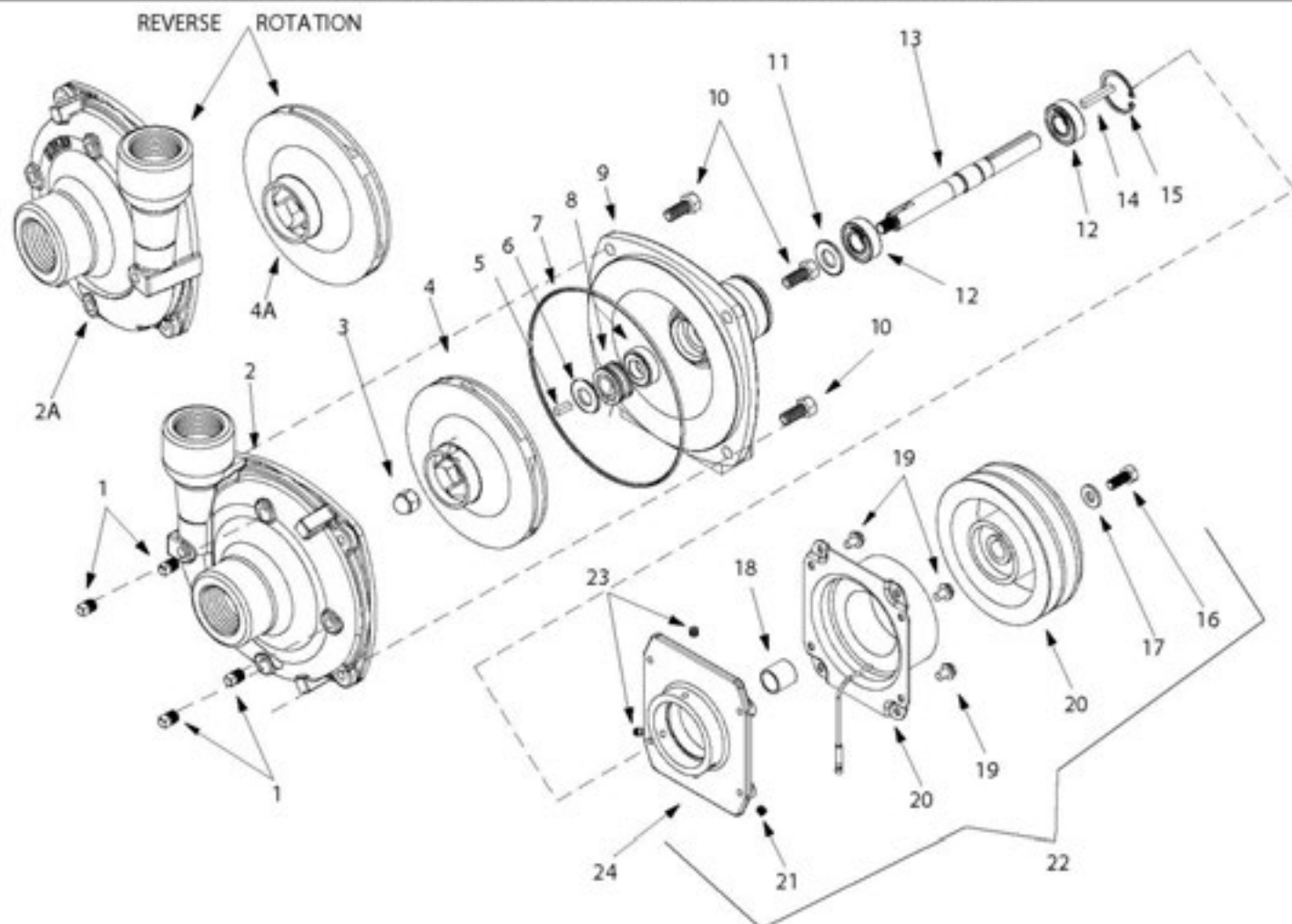
1

Item	Qty	Part Number	Description
1	1	SPR-8283	GX 270 Honda Engine
2	1	HYP-9263C-C	Hypro Pump with Clutch
2A	1	HYP-9203C	Hypro Pump (Not Shown)
2B	1	HYP-3430-0592	Clutch/Flange Kit (Not Shown)
3	1	SPR-4761	Pulley
4	1	SPR-4765	1" Split bushing
5	1	SPR-4767	V-Belt A42
6	1	FAB-3028	Belt Guard, Skid
7	4	FAS-SHC-3/8-16X1 1/2-S	3/8-16 x 1 1/2 Hex Cap Screw
8	2	FAS-SHC-3/8-16X1 1/4-S	3/8-16 x 1 1/4 Hex Cap Screw
9	6	FAS-WLO-3/8-S	3/8 Lock Washer
10	4	FAS-WUS-3/8-S	3/8 USS Washer
11	1	FAB-3046	Hypro Pump Tap Block - Skid
12	2	FAS-SHC-5/16-18X2 3/4-S	5/16-18 x 2 3/4 Hex Cap Screw
13	2	FAS-WUS-5/16-S	5/16 USS Washer
14	2	FAS-NYS-5/16-18-S	5/16-18 Nyloc Nut
15	1	SPR-8330	Hour Meter (Not Shown)



<i>NORSTAR</i> INDUSTRIES, INC.		2302 A St. S.E. Auburn WA 98002	
TITLE: HONDA ENGINE WATER PUMP			
DRAWN BY: J GOULET	CHECKED BY:	SCALE: 1:10	PAGE: 1/1
DATE CREATED: 3/2/04	DRAWING NUMBER: ASM-3320-V2	DATE REVISED:	

9203 Cast Iron and Stainless Steel Series



Seal Kit for Stainless Series:
No. 3430-0589 consists of:
(1) Ref. 7 O-Ring
(1) Ref. 8 Mechanical seal

Seal Kit for Cast Iron Series
No. 3430-0332 consists of:
(1) Ref. 7 O-Ring
(1) Ref. 8 Mech. seal
(1) Ref. 6 Gasket

Note: When ordering parts, give quantity, part number, description and complete model number. Reference numbers are used ONLY to identify parts in the drawing and NOT to be used as order numbers.

No.	Qty. Req'd.	Part No.	Description
1	4	2406-0007	Drain Plug (Cast series)
1	4	2406-0016	Drain Plug (316 Stainless series)
2	1	0150-9000C	Pump Casing (Cast series)
2	1	0150-9000S	Pump Casing (Stainless series)
2A	1	0152-9000C	Pump Casing (Reverse)(Cast series)
2A	1	0152-9000S	Pump Casing (Reverse)(Stainless)
3	1	2253-0002	Impeller Nut (Cast series)
3	1	2253-0006	Impeller Nut (Stainless series)
4	1	0401-9100P	Impeller (Model 9203C) (Nylon)
4	1	0402-9100P	Impeller (Model 9203S) (Poly)
4A	1	0404-9100P	Impeller (Reverse)(Cast series)
4A	1	0403-9100P	Impeller (Reverse)(Stainless series)
5	1	1610-0015	Key (Cast series)
5	1	1610-0057	Key (Stainless series)
6	1	1700-0100	Gasket (Cast series)
7	1	1720-0083	O-Ring
8	1	2120-0008	Mechanical Seal (Optional Buna-N)
8	1	2120-0009	Mechanical Seal (Cast series)

Ref. No.	Qty. Req'd.	Part No.	Description
8	1	3430-0589	Mech. Seal (Silicon Carbide) (Stainless) Includes ref #5 O-Ring
9	1	0750-9200C3	Mounting Flange (Cast series)
9	1	0756-9200S	Mounting Flange (Stainless series)
10	4	2210-0020	Bolt (Cast series)
10	4	2210-0125	Bolt(Stainless series)
11	1	1410-0056	Slinger Ring
12	2	2000-0010	Ball Bearing
13	1	0505-9200	Pump Shaft
14	1	1610-0014	Key
15	1	1820-0013	Bearing Retainer
16	1	2210-0003	Bolt
17	1	2270-0092	Retaining Washer
18	1	1410-0107	Spacer
19	4	N/A	Bolt (part of clutch assy)
20	1	2526-0012	Clutch
21	3	2230-0001	Setscrew
22	1	3430-0592	Clutch Kit

Repair Instructions

Recommended repair tools for use with these instructions:



Always flush pump with water, or neutralizing agent, before servicing.

Pump Housing Disassembly (All Models)

In most cases, seal replacement requires disassembly of only the pump half of the unit.

NOTE: Instructions following in *italics* describe procedures for the polypropylene centrifugal pumps when different than the cast iron pumps.

1. Remove the four casing cap screws with 9/16" box end wrench. Tap pump casing on discharge port with rubber hammer, if necessary, to break loose from mounting flange. Check inside of pump casing including suction port.

If badly eroded [or damaged], pump casing should be replaced. Remove o-ring and discard. O-ring should always be replaced. [Using a 1/2" wrench, remove the six bolts from the front. Also remove the 5/16" screw from the rear near the outlet port.]

2. To remove the impeller nut, clamp the flange in a vise and insert a large screwdriver or file (at least 10" long) into impeller vanes to prevent impeller from turning when loosening nut. Use a socket wrench (3/4" for Series 9000C or 5/8" for Series 9200C and 9400C) to remove the impeller nut by turning it counterclockwise (Fig. A). [Use 7/8" deep socket wrench to remove plastic seal nut, then 9/16" deep socket to remove metal jam nut, rubber gasket and washer.]
3. Once the nut [and washer] is removed, place a screwdriver on each side (Fig. B) behind the impeller and pry away from the mounting flange. Remove woodruff key from the shaft (for Series 9000 only). Remove o-ring from the mounting flange. **NOTE:** Fig. B shows 9000C gear flange. The same general procedure applies for the other pumps.

Pump Seal Removal

1. Lightly lubricate shaft for easier removal of seal. Using two screwdrivers positioned opposite each other, pry the rotary portion of the seal from the shaft (Fig. C).
2. [Remove plastic back cover flange. Knock seal out from back with a hammer and screwdriver.]
3. Remove stationary seat and boot by prying out with two small screwdrivers in manner similar to impeller removal. **(Caution: The seal will be damaged by removal in this manner. A new seal and rubber gasket MUST be used when pump is reassembled.)**

Cleanup Of Pump Housing

1. Using the circular bottle-type wire brush with air or hand drill, clean the discharge port, suction port and the sealing areas of the o-ring on the pump casing and mounting flange. [The last step should not be performed on the polypropylene models.]
2. After wire brush cleaning, it is recommended that the pump casing and mounting flange be further cleaned in a solvent tank to remove rust and corrosion particles.

Pump Shaft and Bearing Assembly Removal and Replacement

1. While the pump is disassembled (see the Pump Housing Disassembly section), the driven pulley on the pump shaft must be removed. Remove the large retainer ring in pump bearing bore on the pulley side of housing. Press out the shaft and bearing assembly from the pump side using an arbor press.
2. Bearings must be pressed off each end of shaft and replaced in the same manner. **NOTE:** Shaft diameter between bearings is larger.
3. For reassembly, reverse the order of instructions.

Seal Replacement/Pump Housing Reassembly

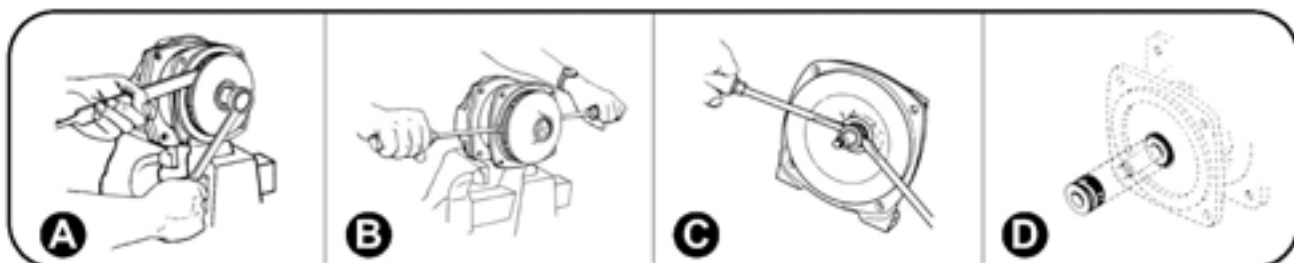
NOTE: Reassemble if drive end is not to be repaired.

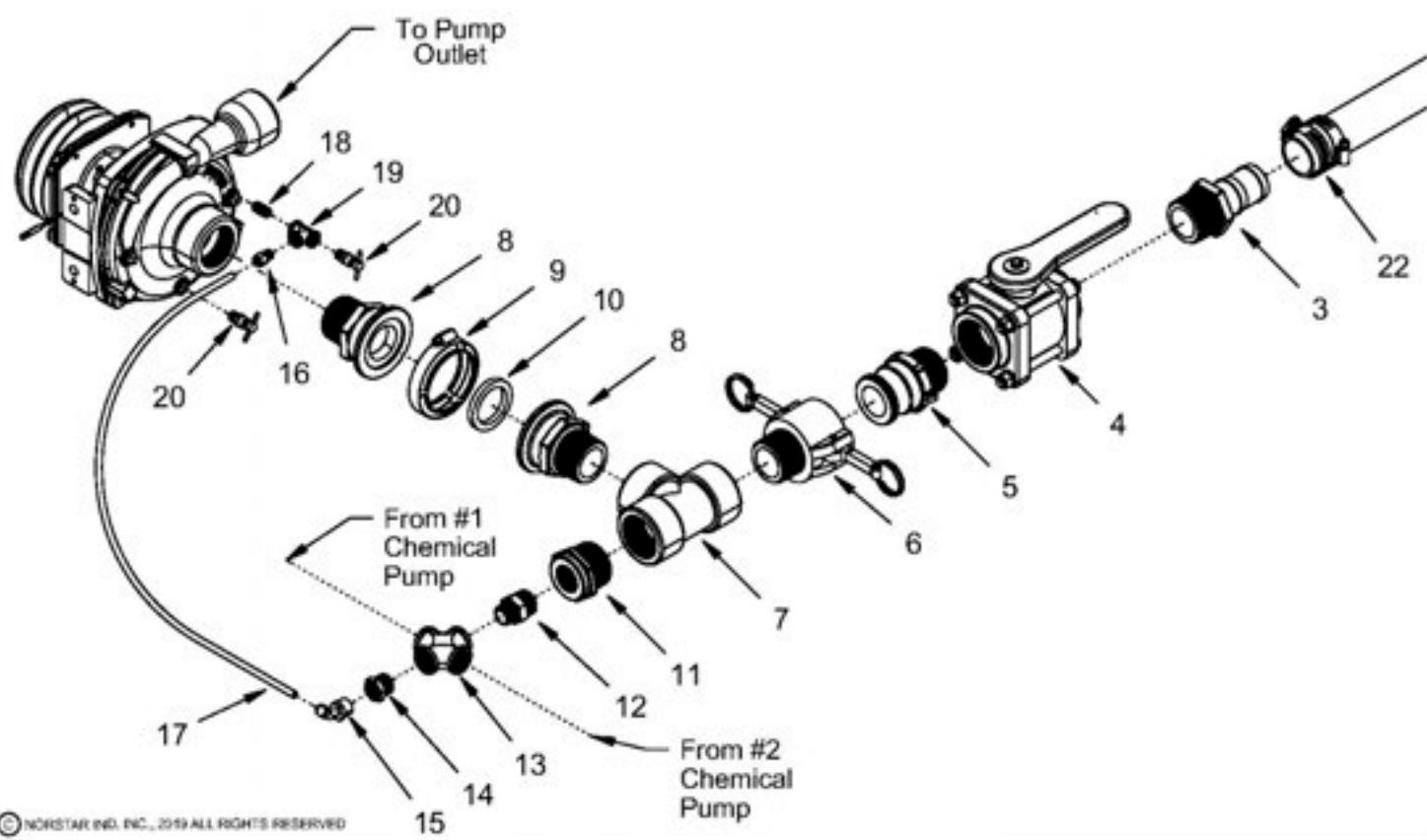
Be extremely careful with the new seal. Take special care not to scratch the lapped sealing faces of the rotary washer and stationary seat.

1. Lubricate seal cavity in mounting flange with WD-40, LPS or equivalent.
2. Install the stationary portion of the mechanical seal by sliding over the shaft with the ceramic side out.

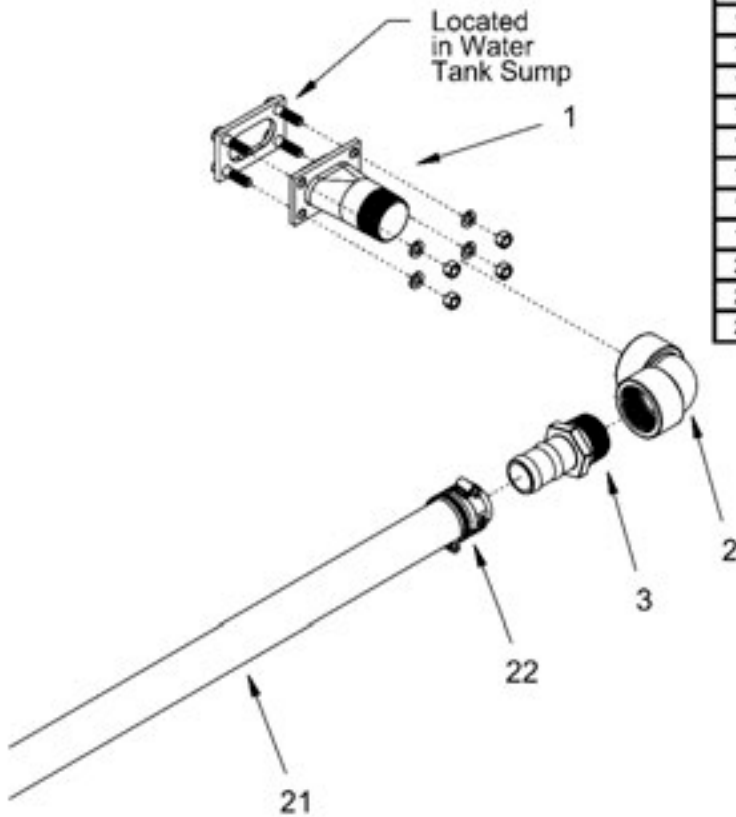
IMPORTANT: Make sure the seal cavity is clean and lubricated. Never run the sealing faces dry.

3. To seat the seal in the seal cavity, use a piece of 3/4" PVC pipe 4" to 6" in length. Press it in firmly and squarely.
4. To install the rotary portion of the mechanical seal, place it over the shaft with the carbon side facing in, and press until it bottoms out against the stationary portion (Fig. D).
5. Insert key into shaft key slot. Place impeller on shaft. Put [washer, jam nut and gasket] impeller nut on shaft end, and using a large screwdriver or file in the impeller vanes for support, tighten impeller nut securely.
6. Install o-ring on mounting flange. Replace o-ring if worn or damaged.
7. Place pump casing on mounting flange, insert and tighten bolts evenly.

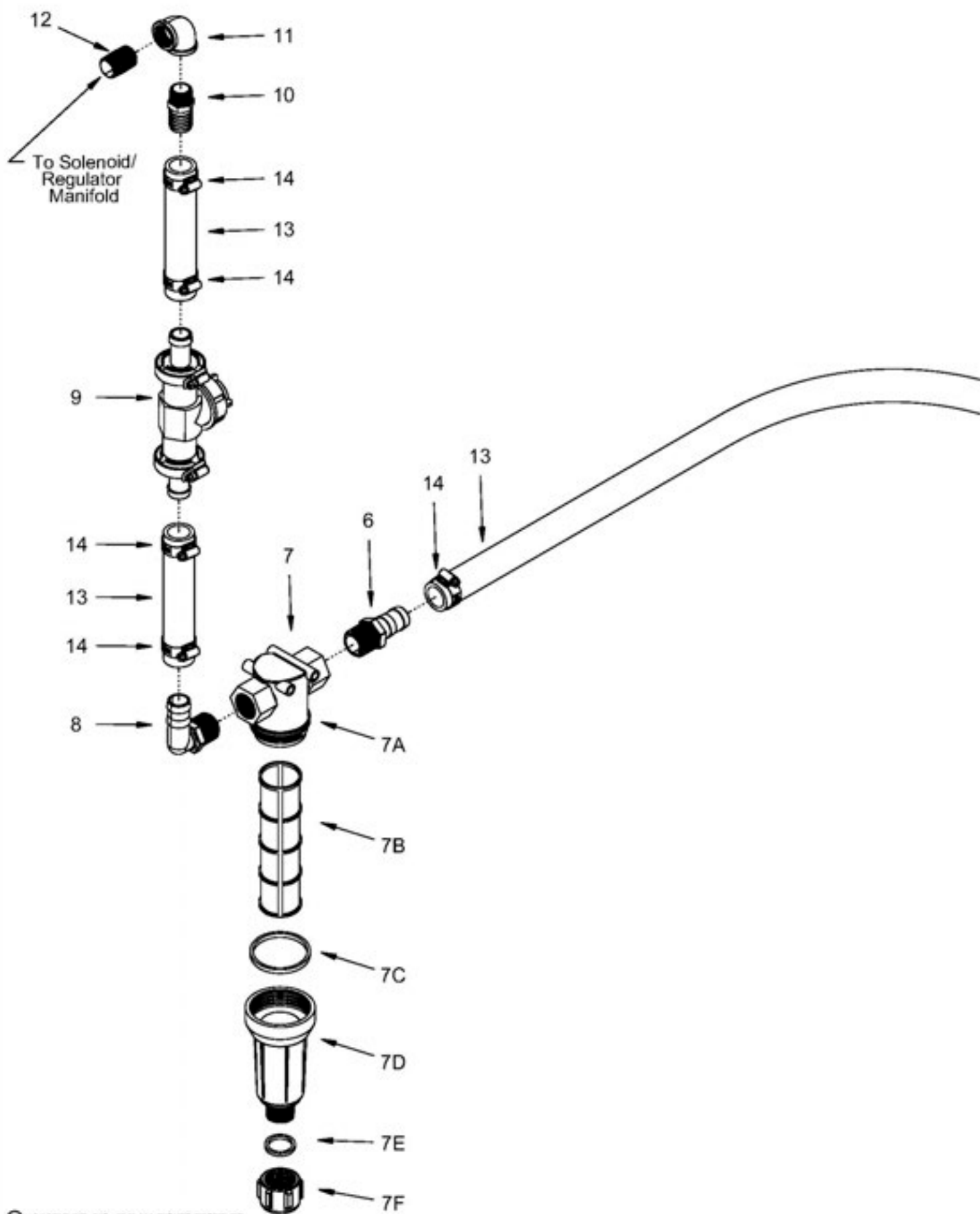




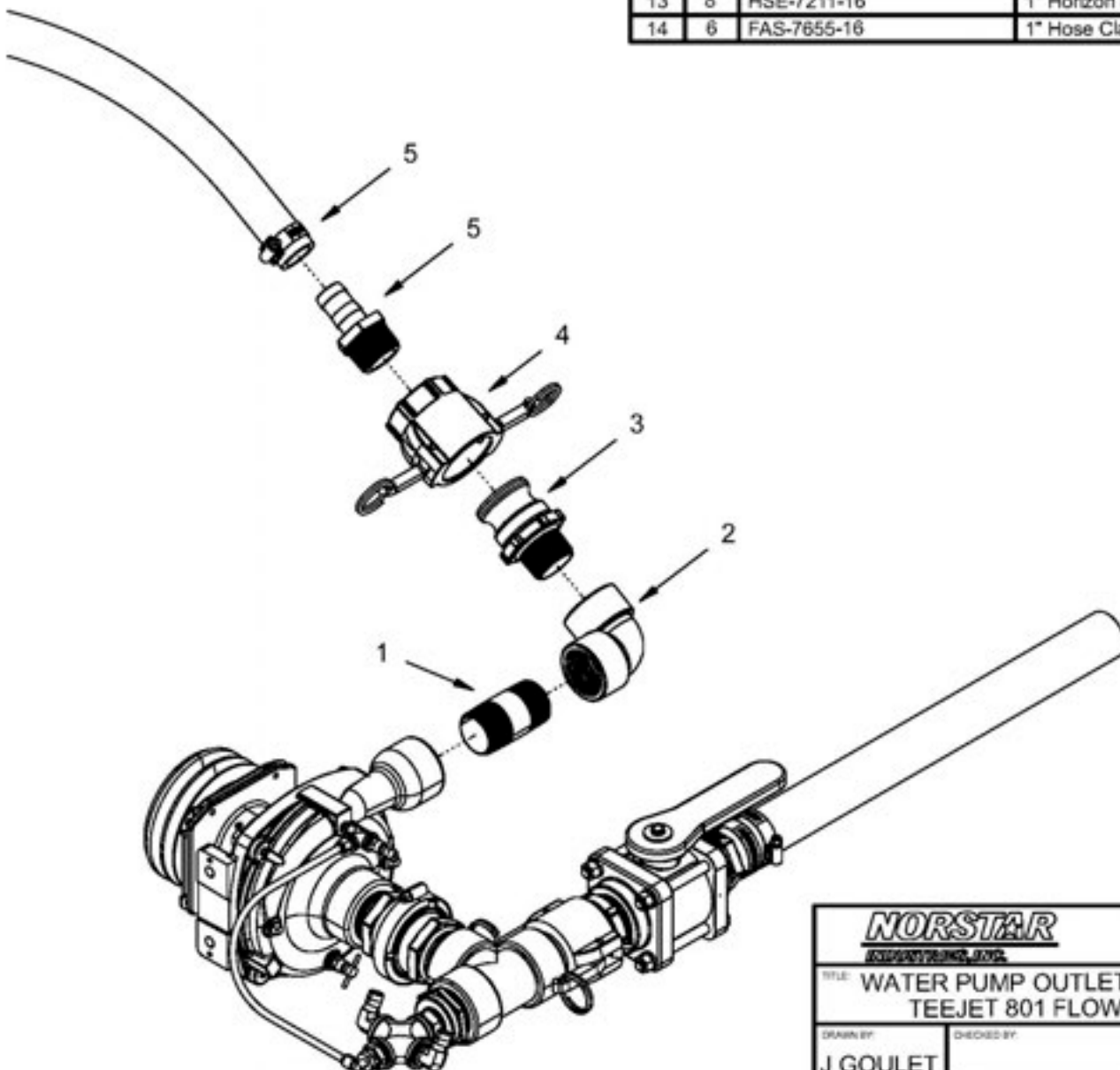
Item	Qty	Part Number	Description
1	1	ASM-3241-V2	Skid Suction Bulkhead
2	1	PPF-9EL-24FP	1 1/2" Poly 90° Elbow
3	2	PPF-SBR-24BX24MP	1 1/2" Poly Hose Barb
4	1	PPF-V2B-24FP	1 1/2" Poly Ball Valve
5	1	PPF-MQD-24MP	1 1/2" Poly Male Camlock
6	1	PPF-FQD-24MP	1 1/2" Poly Female Camlock
7	1	PPF-TEE-24FP	1 1/2" Poly Tee
8	2	PPF-ADP-24FLX24MP	2" Std Port x 1 1/2" Male Adapter
9	1	PPF-BJO-24-CLAMP	2" Std Port Flange Screw Clamp
10	1	PPF-BJO-24-GASKET	2" Std Port EPDM Gasket
11	1	PPF-BSH-24MPX12FP	1 1/2" x 3/4" Poly Bushing
12	1	BRF-HXN-12MPX8MP	3/4" x 1/2" Brass Hex Nipple
13	1	BRF-CRS-08FP	1/2" Brass Cross
14	1	BRF-BSH-08MPX06FP	1/2" x 3/8" Brass Bushing
15	1	NHP-36946	1/4" x 3/8" 90° Air Fitting
16	1	NHP-36842	1/4" x 1/8" Str. Air Fitting
17	1	NHP-39251	1/4" DOT Air Line
18	1	BRF-NIP-02MP	1/4" Brass Nipple
19	1	BRF-TEE-02FP	1/4" Brass Tee
20	2	SPR-5421	1/8" Drain Cock
21	5'	HSE-7225-24	1 1/2" PVC Suction Hose
22	4	FAS-7655-24	1 1/2" Hose Clamps



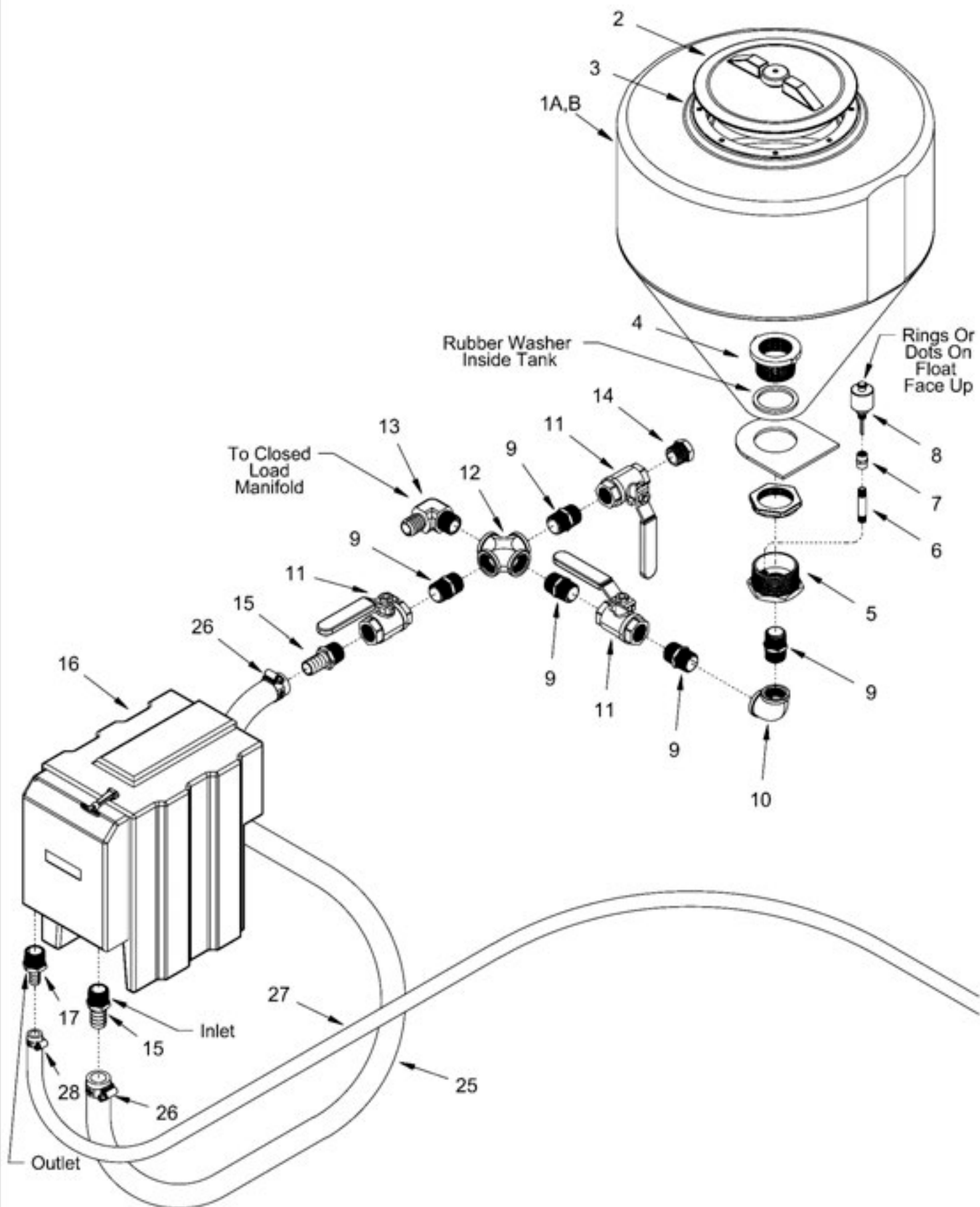
<u>NORSTAR</u> MANUFACTURING, INC.		2302 A St. S.E. Auburn WA 98002	
TITLE WATER PUMP INLET PLUMBING			
DRAWN BY J GOULET	CHECKED BY	SCALE 1:7	PAGE 1/1
DATE CREATED: 6/8/07	DRAWING NUMBER: ASM-1012-V3 - GAS	DATE REVISED: 5/31/19	

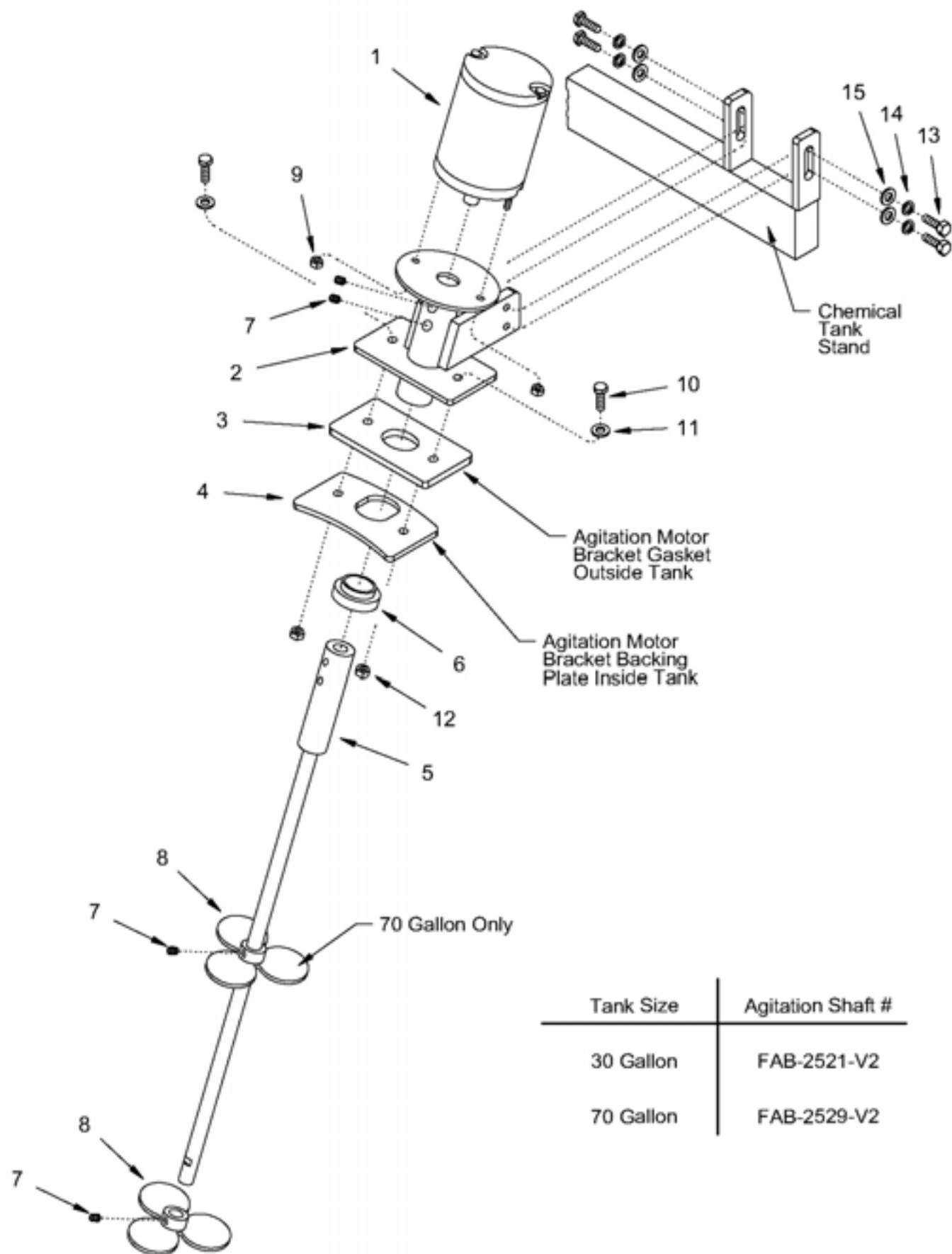


Item	Qty	Part Number	Description
1	1	BRF-NIP-20MPX3	1 1/4" x 3" Brass Nipple
2	1	PPF-9EL-20FP	1 1/4" Poly 90° Elbow
3	1	PPF-MQD-20MP	1 1/4" Poly Male Camlock
4	1	PPF-FQD-20FP	1 1/4" Poly Female Camlock
5	1	PPF-SBR-16BX20MP	1" x 1 1/4" Brass Hose Barb
6	1	PPF-SBR-16BX16MP	1" Brass Hose Barb
7	1	SPS-AA126ML-4-50	1" AA126 Strainer
7A	1	SPS-CPB50492-1-PP	1" AA126 Strainer Head
7B	1	SPS-CP16903-4-SS-PP	Screen 50 mesh
7C	1	SPS-CP50494-EPR	EPDM Gasket
7D	1	SPS-CP50493-PP	Strainer Bowl
7E	1	SPS-CP63150-EPR	EDPM Drain Cap Gasket
7F	1	SPS-CP48655-PP	Poly Drain Cap
8	1	PPF-9BR-16BX16MP	1" Poly 90° Hose Barb
9	1	MID-90-02176	801 Flow Meter 1" Barbs
9A	1	MID-90-02252	Repair Kit (Not Shown)
10	1	BRF-SBR-16BX12MP	1" x 3/4" Brass Hose Barb
11	1	BRF-9EL-12P	3/4" Brass 90° Street Elbow
12	1	BRF-NIP-12PX1.5	3/4" x 1 1/2" Brass Nipple
13	8'	HSE-7211-16	1" Horizon Hose
14	6	FAS-7655-16	1" Hose Clamps

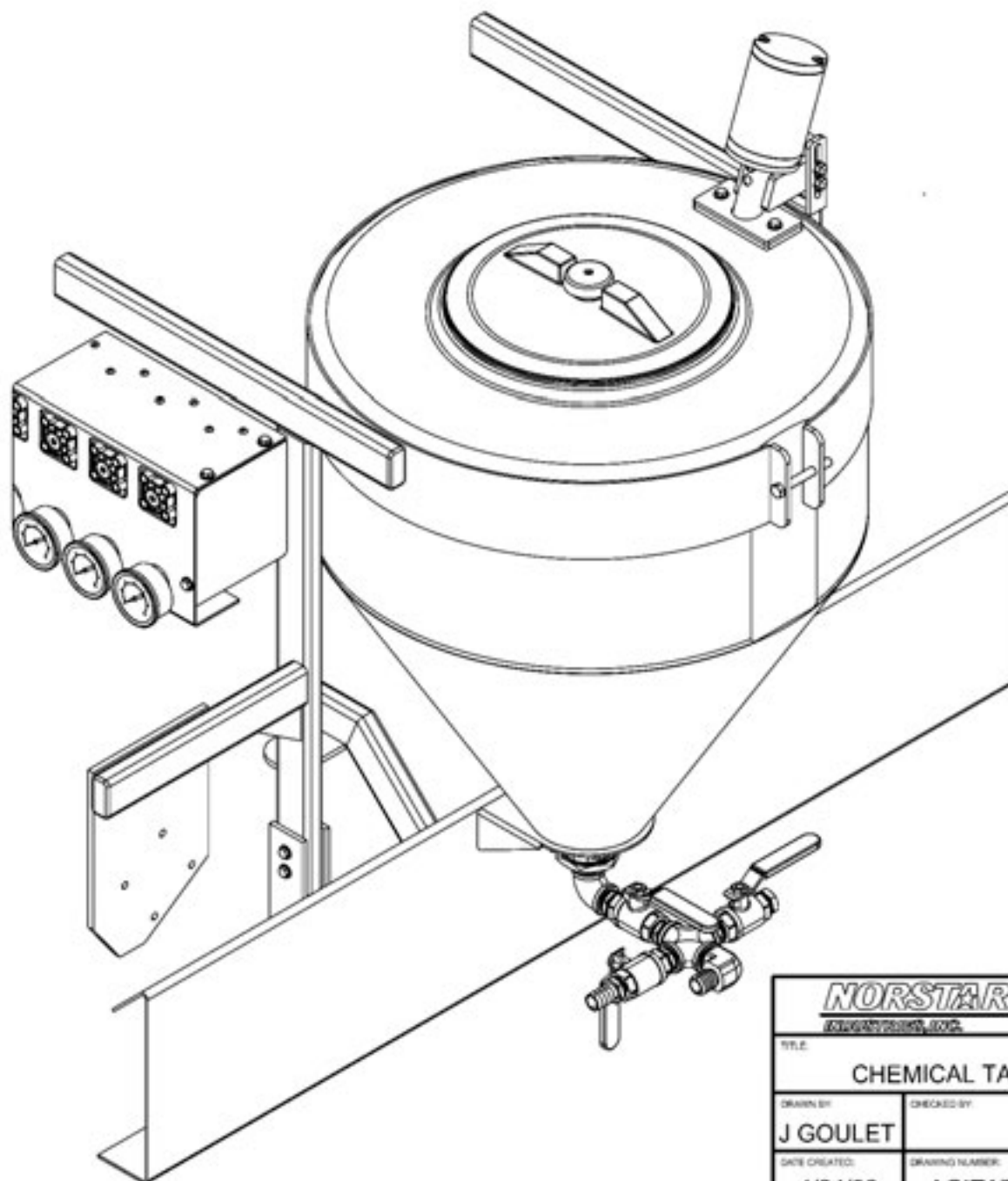


<u>NORSTAR</u> <u>PLUMBING, INC.</u>		2302 A St. S.E. Auburn WA 98002	
TITLE: WATER PUMP OUTLET PLUMBING TEEJET 801 FLOW METER			
DRAWN BY: J GOULET	CHECKED BY:	SCALE: 1:5.5	PAGE: 1/1
DATE CREATED: 6/8/07	DRAWING NUMBER: ASM-1013	DATE REVISED: 3/31/19	



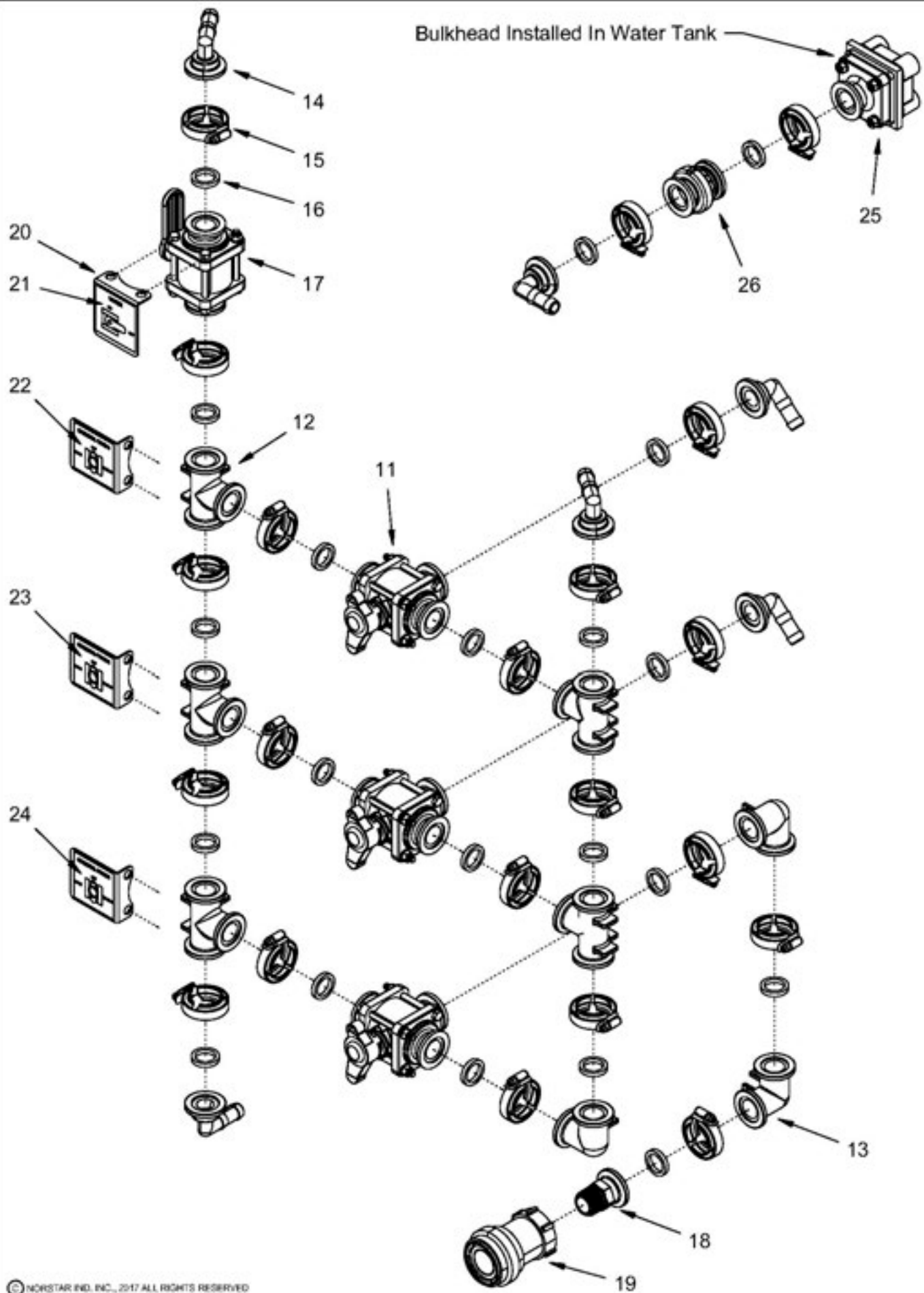


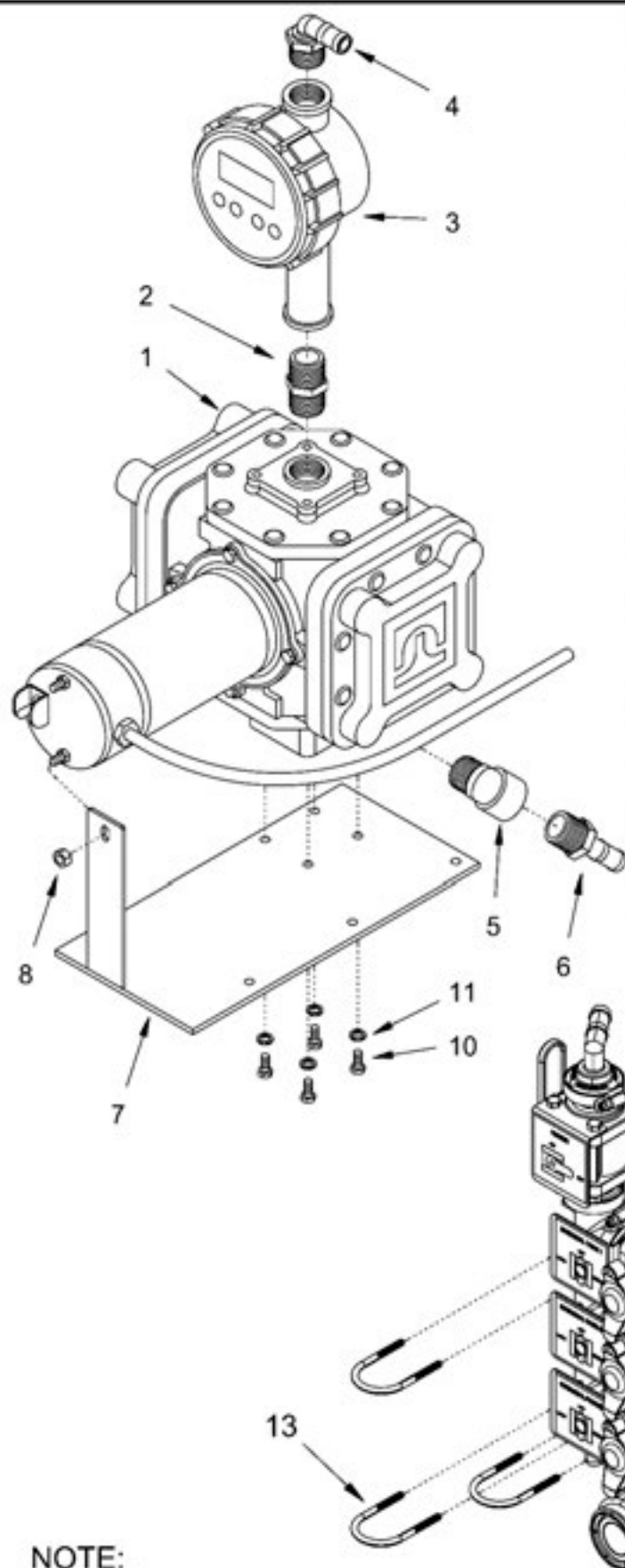
Item	Qty	Part Number	Description
1	1	SPR-6150	Agitation Motor
2	1	FAB-2530	Agitation Motor Bracket Assy
3	1	SPR-6152	Agitation Motor Bracket Gasket
4	1	FAB-2532	Agitation Motor Bracket Backing Plate
5	1	FAB-25XX-V2 (See Note)	Agitation Shaft
6	1	FAB-2533	Agitation Shaft Seal
7	3 or 4	FAS-SSS-1/4-20X.25-SS	Stainless Set Screw
8	1 or 2	FAB-2512	Stainless Agitation Prop
9	2	FAS-NYS-10-32-SS	10-32 Stainless Nyloc Nut
10	2	FAS-SHC-1/4-20X1-SS	1/4-20 x 1 Stainless Hex Cap Screw
11	2	FAS-WSA-1/4-SS	1/4" SAE Stainless Washer
12	2	FAS-NYS-1/4-20-SS	1/4" Stainless Nyloc Nut
13	2	FAS-SHC-5/16-18X3/4-S	5/16-18 x 3/4 Hex Cap Screw
14	2	FAS-WLO-5/16-S	5/16" Lock Washer
15	2	FAS-WUS-1/4-S	1/4" Flat Washer



NORSTAR MANUFACTURING, INC.		2302 A St. S.E. Auburn WA 98002	
TITLE: CHEMICAL TANK AGITATION			
DRAWN BY: J GOULET	CHECKED BY:	SCALE: 1:5	PAGE: 1/1
DATE CREATED: 4/24/03	DRAWING NUMBER: AGITATORS-V2	DATE REVISED: 2/4/05	

Bulkhead Installed In Water Tank



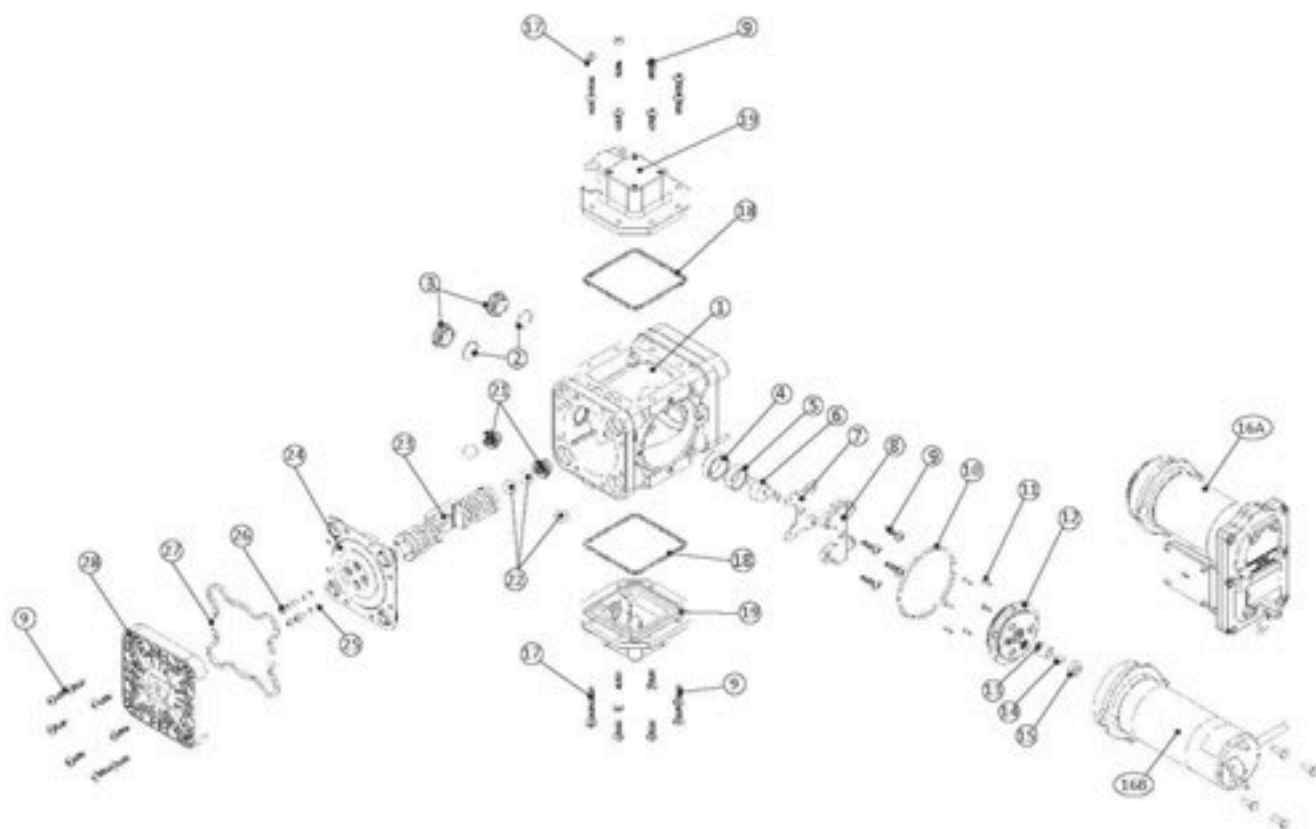


Item	Qty	Part Number	Description
1	1	SPR-5615	Sotera Model 415 Pump
2	1	PPF-HXN-16MP	1" MPT Hex Nipple
3	1	SPR-6560	Sotera Digital Flow Meter
4	1	PPF-9BR-12BX16MP	3/4" x 1" 90° Hose Barb
5	1	PPF-4SL-16MPX16FP	1" 45° Street Elbow
6	1	PPF-SBR-12BX16MP	3/4" x 3/4" Hose Barb
7	1	FAB-2280	Sotera Pump Mounting Bracket
8	1	FAS-NTL-1/4-20-S	1/4-20 Toploc Nut
9	6	FAS-NSD-1/4-20-S	1/4-20 Hex Nut
10	4	FAS-SHC-1/4-20X1/2-S	1/4-20 x 1/2" Hex Cap Screw
11	10	FAS-WLO-1/4-S	1/4" Lock Washer
12	1	FAB-2282	Skid Manifold Bracket
13	3	FAS-UBT-20	U-Bolt
14	3	PPF-V3B-16FL	3 way bottom loading poly valve
15	5	PPF-TEE-16FL	1" Flanged Tee
16	3	PPF-9EL-16FL	1" Flanged 90° Elbow
17	6	PPF-9BR-12BX16FL	1" Flange x 3/4" 90° Barb
18	21	PPF-BJO-16-CLAMP	1" Flange Screw Clamp
19	21	PPF-BJO-16-GASKET	1" Flange Viton Gasket
20	1	PPF-V2B-16FL	1" Flanged Poly Ball Valve
21	1	PPF-ADP-16FLX16MP	1" Flange x 1" Male Pipe Adapter
22	1	SPR-4207	1" Flat Face Female QD - Poly
23	4	FAB-2283	Manifold Label Bracket
24	1	SPR-9704	Fresh Water Label
25	1	SPR-9700	Chemical Tank 1 Label
26	1	SPR-9701	Chemical Tank 2 Label
27	1	SPR-9703	Chemical Probe Label
28	1	PPF-BHD-16FL	1" Flange Bulkhead Fitting
29	1	PPF-CV-16FL	1" Flange Check Valve
	25'	HSE-7225-12	3/4" PVC Suction Hose
	12	FAS-7655-10	3/4" Gear Clamp

NOTE:

1. Standard skid 2 chemical pump configuration.
2. 3/4" Hoses & clamps not shown for clarity.

NORSTAR MANUFACTURING, INC.		2300 A St. S.E. Aurora WA 98002	
TITLE INJECTION SKID CLOSED LOADING			
DRAWN BY J GOULET	CHECKED BY	SCALE 1:6	PAGE 1/1
DATE CREATED 12/6/07	DRAWING NUMBER NSC-90157	DATE REVISED 8/28/16	



Parts List

Item	Description	Qty
1	Pump Body	1
2	O-Ring Nitrile, -022	2
3	Sight Cap	2
4	Bearing Ring	1
5	Bushing, 1.250 OD. x 1.00 ID.	1
6	Drive Shaft	1
7	Thrust Plate	1
8	Bearing Plate	1
9	Screw, 1/4 - 10 x 1.00 PTS-SS	32
10	O-Ring, Lathe Cut Nitrile	1
11	Screw, 6-32 Flat Head Trilobular	6
12	Gear Pack Assembly	1
13	Drive Gear	1
14	Key, Rotor	1

Item	UL Listed / CE Certified Motors	Qty
16A	12V DC CE Compliant Explosion Proof	1
16A	12V DC UL Listed Explosion Proof	1
16A	24V DC UL Listed Explosion Proof	1
16A	115V AC UL Listed Explosion Proof	1

Item	Description	Qty
15	Shaft Lip Seal, 400 Motor Shaft	1
16A	Motor Assembly (see charts below for motor specifics)	1
16B		
17	Screw, 1/4 - 10 x 2.25 PTS-SS	4
18	Flange Gasket - EPDM	2
19	90 Degree Flange with Inserts	2
20	Screw, 1/4 - 20 x .750 LG	4
21	Outlet Check Valve	4
22	Ball	8
23	Yoke Assembly	1
24	Diaphragm Assembly	2
25	O-Ring, EPDM, -007	8
26	PHM Screw, 10 - 24 x .5 LG	8
27	Diaphragm Cover Gasket - EPDM	2
28	Diaphragm Covers	2

Item	Standard Duty Motors	Qty
16B	12V DC	1
16B	115V AC	1

When ordering kits or parts, be sure to give the replacement part number, date of manufacture, and pump serial number. This will ensure the correct part is ordered.

WARNING! Always switch pump off and disconnect

WARNING! Always flush pump completely prior to any service or disassembly. Use water, or an appropriate flushing fluid for the fluids being pumped. **DO NOT USE PRESSURIZED WATER OR PRESSURIZED AIR** to flush your Sotera Systems pumps. Damage to the equipment will occur if flush water pressure exceeds 15 psi (1 bar). Instead, submerge the suction tube or inlet adapter in clean water and dispense water by operating the pump. Dispose of the flush water properly. After flushing, pump air to remove as much water as possible.

WARNING! DO NOT disassemble the yoke assembly. It is under extreme pressure, and serious injury or death may result!

IMPORTANT! Do not allow chemicals to remain in the pump for any extended period of time, whereby the chemicals are allowed to “dry out.” Thoroughly rinse pump and meter by flushing the pump with water or appropriate flushing fluid.

IMPORTANT! The pump body is filled with oil at the factory to lubricate the internal gear drive mechanism for the diaphragms. Certain repair and maintenance procedures require draining of the oil, while others do not. If you need to drain the oil, remove one fluid sight cap (item 30) from the pump body. Stand the pump on its end and drain the oil via the sight cap port into a container approved for standard 30W motor oil. Always use new oil after draining.

Routine Annual Maintenance or as needed.

1. Tighten all external torx head screws to 75 in. lbs. (items 9 & 17).

2. Drain oil through sight caps and replace oil with approximately 16 ounces of automotive grade SAE 30W through one of the sight cap holes. The oil level should be level with the bottom edge of the sight caps (item 3) located on the front of the pump body.

NOTE: Always check oil level when the pump is level.

NOTE: If external torx head screws (items 9 & 17) are removed, hand start and tighten to 75 in. lbs. Tighten motor flange hex head screws to 50 in lbs.

Diaphragm Assembly/Check Valve Replacement

IMPORTANT! Diaphragms and check valve assemblies can be serviced without removing oil from pump body by servicing one side at a time with diaphragm facing up. It is important during this procedure to make sure no debris or contaminants fall into the oil. Regular maintenance is critical to maintaining performance and extending the life of your 400 series pump.

1. Remove 8 diaphragm cover screws (Torx T30) and diaphragm cover (item 9).

2. Remove retainer screws (item 26) and o-rings (item 25) (Phillips Head #2)

3. Remove diaphragm assembly by pulling check valves out of pump body; **be careful not to damage surface of body.**

CAUTION! USE CARE in removing the diaphragm and check valve assemblies from the pump body to avoid damage to the pump body. **DO NOT** pry the diaphragm / check valve assembly away from the

pump body with sharp or metal tools. Scratching or otherwise damaging the pump body may cause leaks.

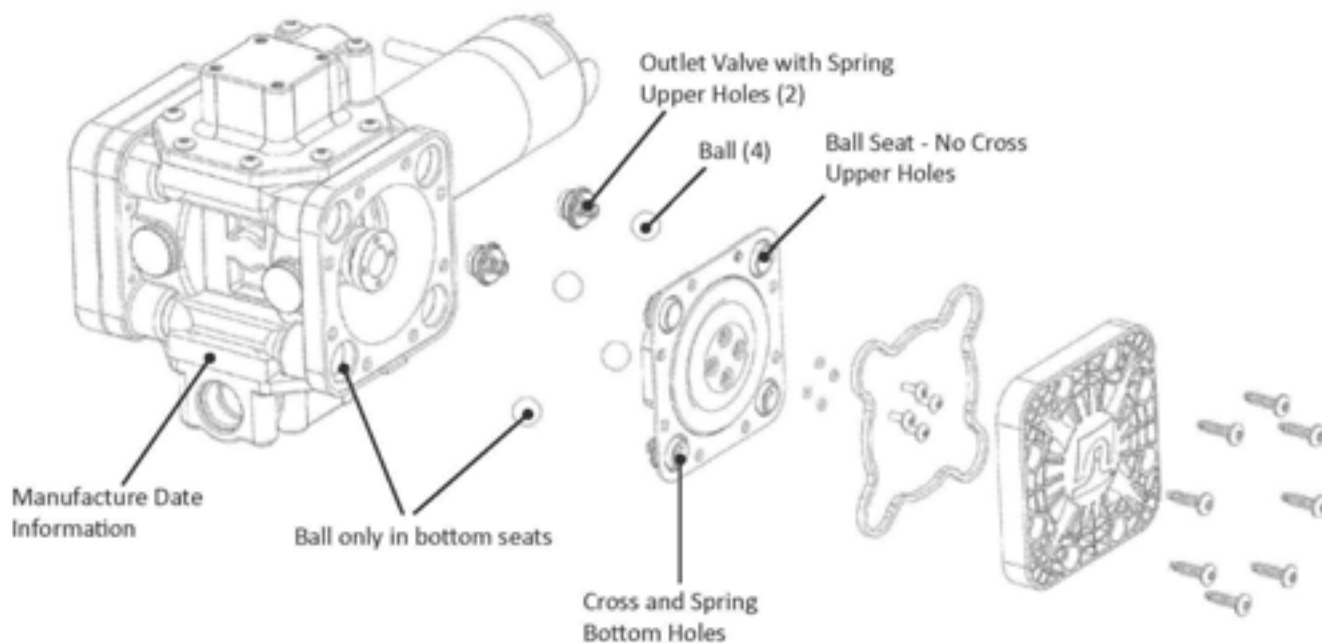
4. Install new diaphragm assembly in the same orientation as the one that was removed.
5. Insert four screws (item 26) and o-rings (item 25) into diaphragm as shown and tighten to 35 in. lbs. of torque.
6. Install diaphragm cover (item 28). **Hand start** and tighten torx head screws to 75 in. lbs.

To further disassemble pump, after #3 above:

7. Remove motor and drain oil, if complete disassembly is required (motor removal instructions below).
8. Remove 4 screws (item 9) holding bearing plate (item 8). (Torx T30)
9. Remove bearing plate (item 8) and thrust plate (item 7).
10. Remove drive shaft (item 6), bearing (item 5), bearing

WARNING! DO NOT DISASSEMBLE GEAR ASSEMBLY. Planet gears and ring gear are marked for proper assembly and must not be altered. **DO NOT ATTEMPT TO REPLACE INDIVIDUAL PARTS. REPLACE ENTIRE ASSEMBLY WHEN REQUIRED** (Kit 400F6557).

Diaphragm and Check Valve Orientation Detail



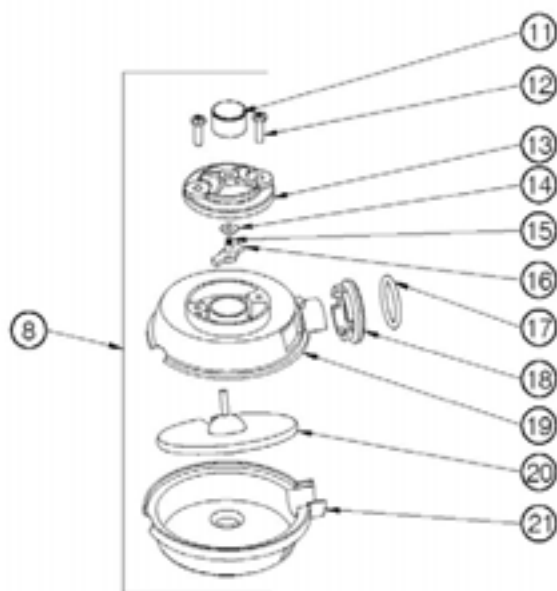
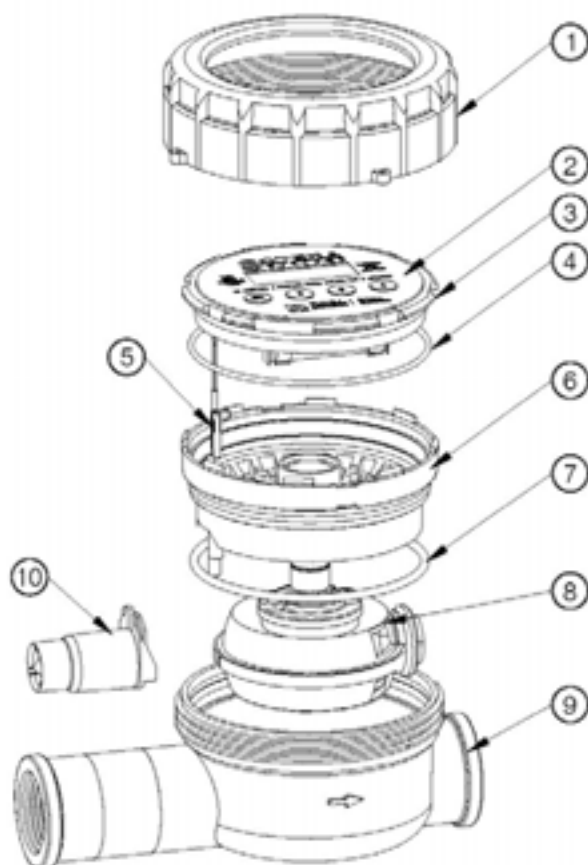
Sotera Diaphragm Pump Troubleshooting Guide

PROBLEM	POSSIBLE CAUSE	SOLUTION
Pump won't prime	<ul style="list-style-type: none">• Suction line problem• Leaky check valves• Check valves improperly installed• Outlet plugged• Motor not operating• Stripped or damaged gears	<ul style="list-style-type: none">• Check for leaks in suction line.• Check for dirt or damaged check valves and replace.• Check for proper installation.• Check for blockage and clear.• Check power source.• Repair or replace motor.• Check gear assembly and drive gear for damage. Replace complete assembly if necessary.
Pump hums but will not rotate	<ul style="list-style-type: none">• Motor faulty• Gear mechanism jammed	<ul style="list-style-type: none">• Replace motor.• Check for free rotation of the gears.
Low pump capacity	<ul style="list-style-type: none">• Low voltage• Leaky suction line• Dirt in check valves• Faulty check valves• One or both diaphragms leaking• One piston screw loose• Piston retainer screws loose• Debris ingested	<ul style="list-style-type: none">• Check power source.• Repair leaks.• Dismantle and clean.• Install repair kit.• Install repair kit.• Install new yoke assembly.• Install new yoke assembly.• Add inlet screen.
Motor overheats	<ul style="list-style-type: none">• Pumping hot fluids• Motor faulty	<ul style="list-style-type: none">• Shorten duty cycle.• Replace motor.
Fluid leakage	<ul style="list-style-type: none">• Faulty or missing gaskets• Loose bolts• Cracked component	<ul style="list-style-type: none">• Install all gaskets specified in parts list.• Torque all bolts to 50 in. lbs.• Replace defective component.

850 METER PARTS LIST			
ITM. NO.	PART NO.	DESCRIPTION	QTY.
1	820F1537	Meter Cap	1
2	850G7887	Display Label	1
3	850G7888	Electronic Module	1
4	800G7389	O-Ring, Buna-N, 96.5 mm ID (Black)	1
5	850G7802	Proximity Switch Retainer	1
6	820F1534	Meter Cover	1
7	820F1552	O-Ring, Fluorocarbon (2-240) (Brown)	1
8	825F1578	Meter Chamber Assembly (Includes items 11-21)	1
9	850G7807	Meter Body	1
10	850G7810	Air Sensor Cartridge Assembly	1

F1582, 850 METER REPAIR KIT			
ITM. NO.	PART NO.	DESCRIPTION	QTY.
4	800G7389	O-Ring, Buna-N, 96.5 mm ID (Black)	1
7	820F1552	O-Ring, Viton (2-240, Brown)	1
8	825F1578	Meter Chamber Assembly (Includes items 11-21)	1

825F1578, METER CHAMBER ASSEMBLY			
ITM. NO.	PART NO.	DESCRIPTION	QTY.
11	825F1577	Magnet Holder	1
12	800F4439	Screw, #6-20 x 1/2 Philips	2
13	800F3955	Pinion Plate	1
14	800F3980	Washer	2
15	800F3965	Pinion Shaft	1
16	800G1304	G1304 Driver	1
17	35F6588	O-Ring (2-117)	1
18	820F1550	Seal Gland	1
19	800F3951	Meter Chamber Top	1
20	800F3941	Meter Disc	1
21	800F3952	Meter Chamber Bottom	1



PATENT
PENDING

WHEN ORDERING REPAIR PARTS, BE SURE TO GIVE REPLACEMENT PART NUMBER, DATE OF MANUFACTURE AND PUMP MODEL NUMBER. THIS WILL ENSURE THAT THE CORRECT REPLACEMENT PART IS SUPPLIED.

Sotera 850 Meter Recalibration Procedure

Over time, the chamber inside the meter will wear, requiring recalibration. The 850 meter is designed to be recalibrated with water for safe handling and to provide a consistent baseline measurement. Recalibrating the meter with clean water will insure the CAL factors remain accurate.

You will need a container of known volume, at least 5 gallons or larger. Do not exceed a 60-gallon container.

1. Press buttons 2 and 4 at the same time and hold for 3 seconds. The display will read the version of the software loaded in the meter (example: "7r1.02")
2. Press button 3 to enter calibration mode. The unit of measure will be displayed.
3. Press the ON button to change the unit of measure, if required.
4. Press button 3. The display will read "FILL".
5. Now dispense fluid into your container. "FILL" will flash on the display. For best results, dispense fluid at the same flow rate that will be used in actual use.
6. After dispensing, press the ON button. The left digit of the display will blink.
7. Press button 4 to increment the digit to the amount of fluid dispensed (example 05.00). Press the ON button to move to the right. If you make a mistake, press button 2 to start back at the left-most digit.
8. After the number is entered, press the ON button again to accept.
9. Display will now show CAL 4. Press the ON button again to accept. The display will again show the software version loaded on the meter.

NOTE: If the value entered is out of an acceptable range, the display will read "Err0" and the meter will revert to the previous settings.

10. Press button 2 to get back to the normal operating mode.

Sotera 850 Meter Battery Replacement Procedure

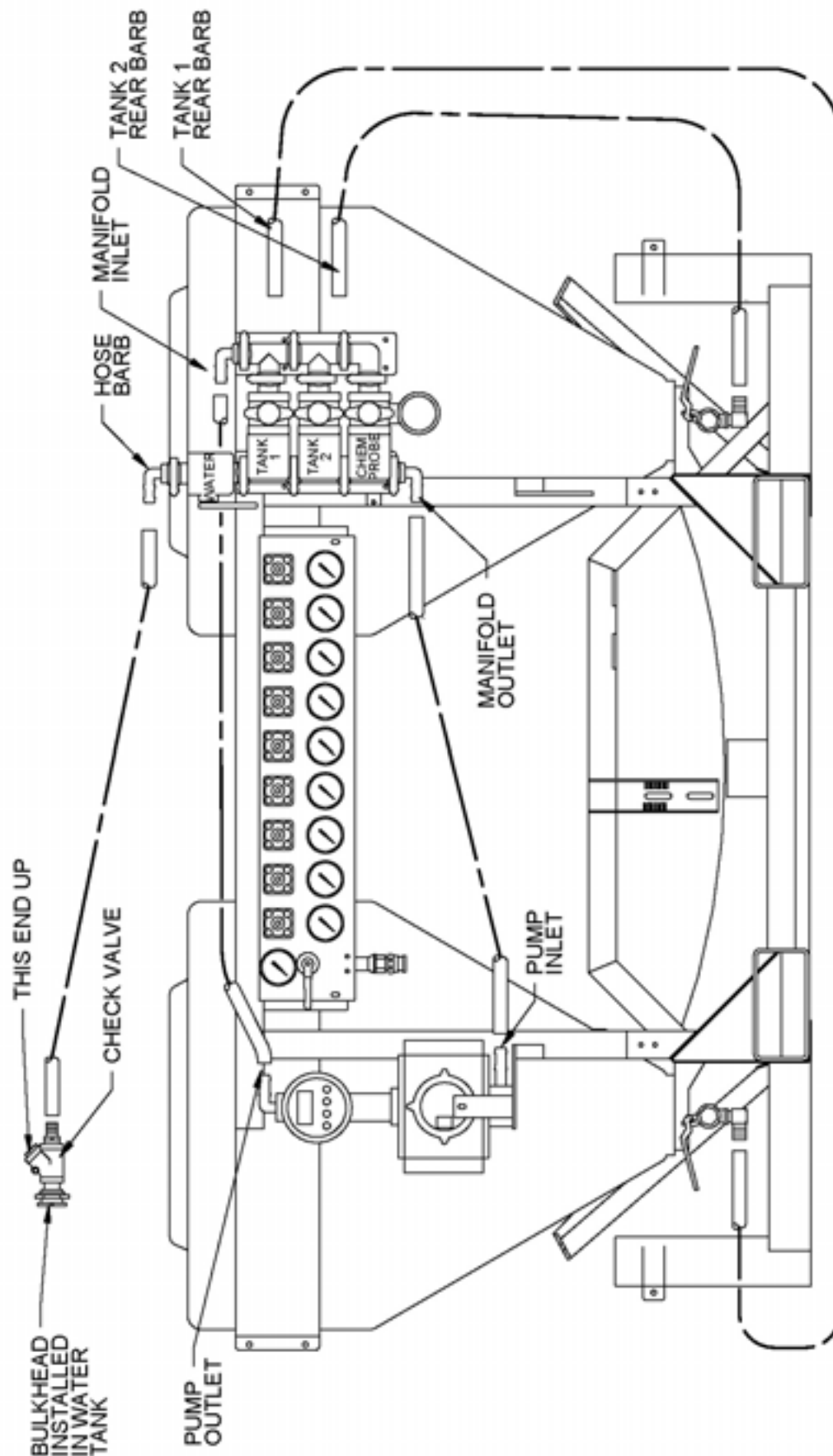
The low battery icon will flash when the batteries begin to lose power. The meter will still function properly for several days after the icon begins to flash. The calibration, current total, and totalizer quantities will not be lost when replacing the batteries.

1. Unscrew the meter cap by hand.
2. Insert a flat-head screw driver into the face plate pry slot and gently pry up the face plate.
3. Gently lift off the face plate being careful to not pull on the lead wire between the face plate and the meter housing.
4. Remove the old batteries and insert new ones, making sure the battery polarity is correct. Meter damage could occur if the batteries are installed incorrectly.
5. Make sure the o-ring is on the meter face plate and press the face plate gently down into the meter housing.
6. Screw the meter cap back onto the meter until hand tight.

Sotera 850 Meter Troubleshooting Guide

Problem	Possible Cause	Solution	Notes
Meter won't turn on	<ul style="list-style-type: none"> Dead batteries Damaged or contaminated electronics module 	<ul style="list-style-type: none"> Replace batteries. Replace electronics module & gaskets. 	Seal to electronic chamber is broken if display label is removed or punctured.
Flashing decimal	<ul style="list-style-type: none"> Current total has rolled over. 	<ul style="list-style-type: none"> Reset meter (if desired). 	Meter will continue to operate normally.
Flashing or dim display	<ul style="list-style-type: none"> Low batteries. 	<ul style="list-style-type: none"> Replace batteries. 	Use alkaline batteries.
Fluid flows; meter won't count	<ul style="list-style-type: none"> Meter disk sticking. Damaged driver or magnet. Meter failure. Air sensor sticking 	<ul style="list-style-type: none"> Clean out meter chamber. Repair or replace chamber assembly. Repair or replace meter. Remove and clean air sensor. 	
Meter reads high	<ul style="list-style-type: none"> Entrained air in system. Wrong calibration factor. 	<ul style="list-style-type: none"> Prime system; fix suction leak at pump. Use a higher calibration factor. Check fluid temperature. 	Meter will count air. Chemical formulations sometimes change.
Meter reads low	<ul style="list-style-type: none"> Wrong calibration factor. Meter chamber is worn. Damaged or severely worn chamber. 	<ul style="list-style-type: none"> Use a lower calibration factor. Check fluid temperature. Recalibrate meter with water[†]. Replace the chamber and recalibrate meter[†]. 	Chemical formulations sometimes change.
Meter is not consistent	<ul style="list-style-type: none"> Entrained air in system. Particulates in fluid. Meter has worn or damaged chamber. 	<ul style="list-style-type: none"> Prime system; fix suction leak at pump. Put screen in front of meter. Replace chamber. 	40 mesh minimum.
Err0	<ul style="list-style-type: none"> Calibration error. Damaged chamber. 	<ul style="list-style-type: none"> Recalibrate meter with more accurate container[†]. Replace chamber. 	Indicates fluid calibration is out of acceptable window. Volumetric container may be off, or the meter chamber may be damaged.
Err1	<ul style="list-style-type: none"> Damaged electronics. Software fault. 	<ul style="list-style-type: none"> Repair or replace electronics. Press button 2 then recalibrate meter[†]. 	Contact factory.
Err2	<ul style="list-style-type: none"> Bad eeprom. 	<ul style="list-style-type: none"> Replace electronics. 	Meter still functions, but all data will be lost if batteries are removed.

[†] See Sotera Model 850 Meter Recalibration Procedure



NOTES:

1. HOSE ROUTING FOR ILLUSTRATION ONLY
2. STANDARD SKID 2 TANK CONFIGURATION

NORSTAR
2302 A ST. S.E.
Auburn WA 98002

TITLE

CLOSED LOADING HOSE ROUTING

DRAWN BY:
J GOULET

CHECKED BY:

SCALE

PAGE

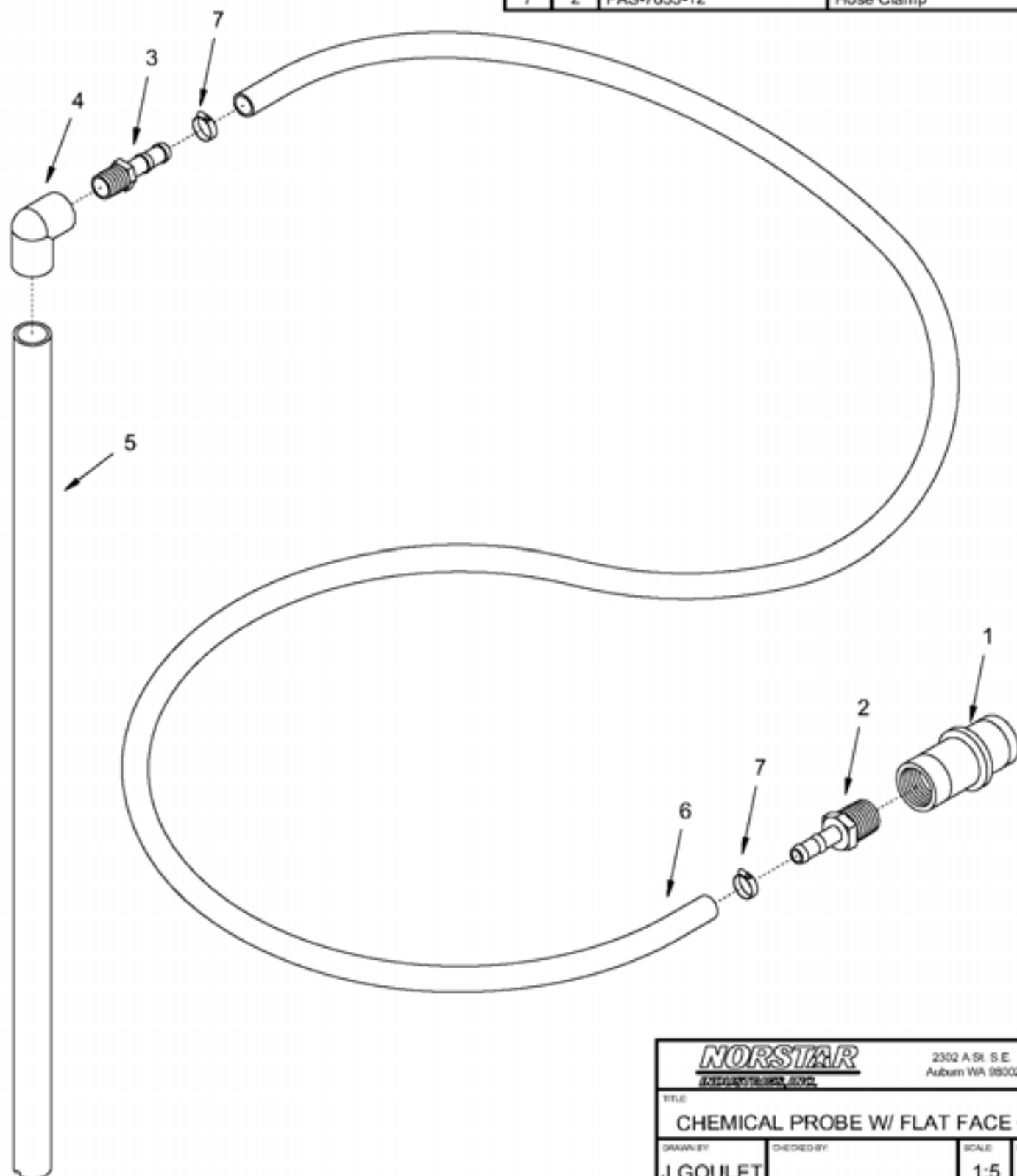
1:10 1/1

DATE CREATED

DRAWING NUMBER

11/7/00

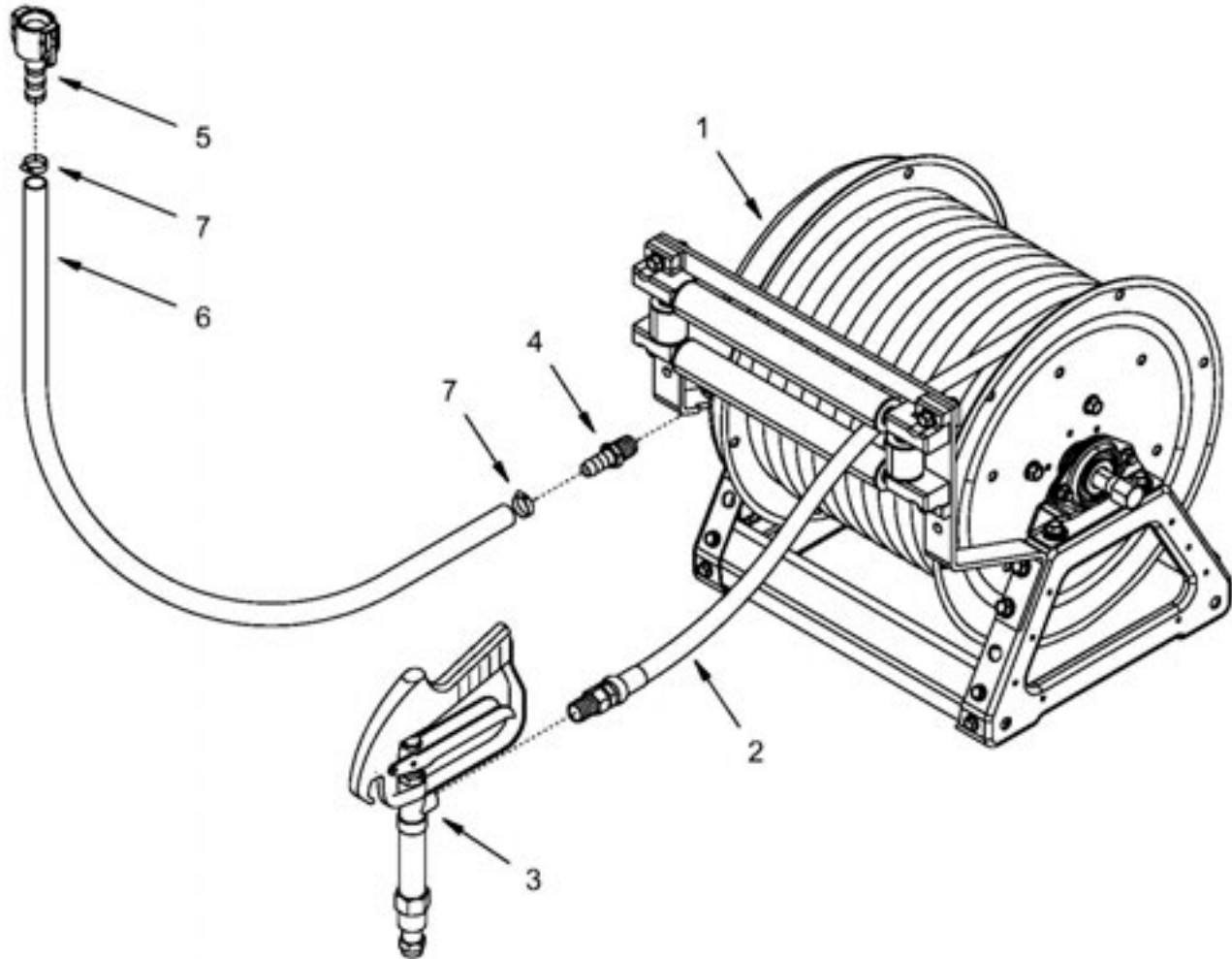
Item	Qty	Part Number	Description
1	1	SPR-4208	1" Flat Face QD Male - Poly
2	1	PPF-SBR-12BX16MP	Hose Barb
3	1	PPF-SBR-12BX12MP	Hose Barb
4	1	PVF-9EL-12FKX12FP	Elbow
5	4'	PVF-PIP-12	3/4" Schedule 40 PVC Pipe
6	12'	HSE-7225-12	3/4" PVC Suction Hose
7	2	FAS-7655-12	Hose Clamp



<u>NORSTAR</u> <u>INSTRUMENTS, INC.</u>		2302 A St. S.E. Auburn WA 98002	
TITLE: CHEMICAL PROBE W/ FLAT FACE QD			
DRAWN BY: J GOULET	CHECKED BY:	SCALE: 1:5	PAGE: 1/1
DATE CREATED: 12/18/07	DRAWING NUMBER: ASM-3316-V2	DATE REVISED:	

Item	Qty	Part Number	Description
1	1	SPR-88**	Hose Reel
2	1	HSE-7245	1/2" PVC Handgun Hose
3	1	SPR-4850	1/2" Handgun
4	1	BRF-SBR-08BX08MP	1/2" X 1/2" MPT Brass Hose Barb
5	1	PPF-FQD-08B	Female QD x 1/2" Hose Barb
6	5'	HSE-7200-08	Bosflex Hose 1/2"
7	2	FAS-7655-06	3/8" Screw Clamp

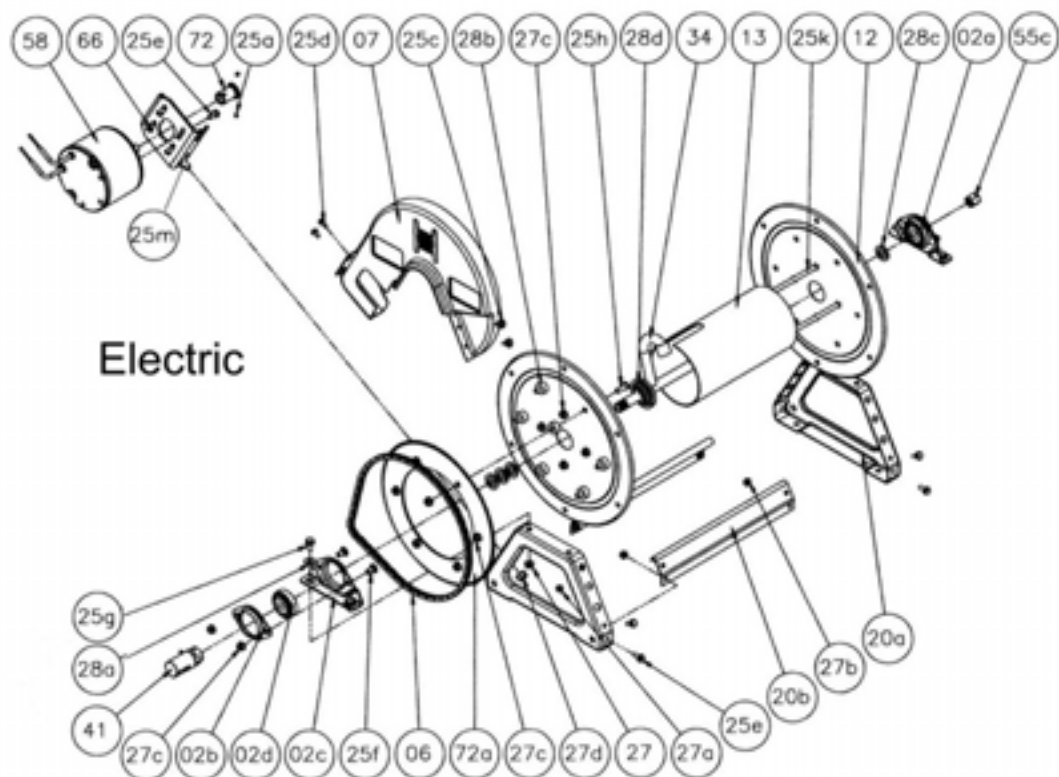
To Flow
Switch On
Solenoid/
Regulator



SPR-8870 75' - 100' Hand Crank Reel
 SPR-8868 150' - 200' Hand Crank Reel
 SPR-8869 300' Hand Crank Reel

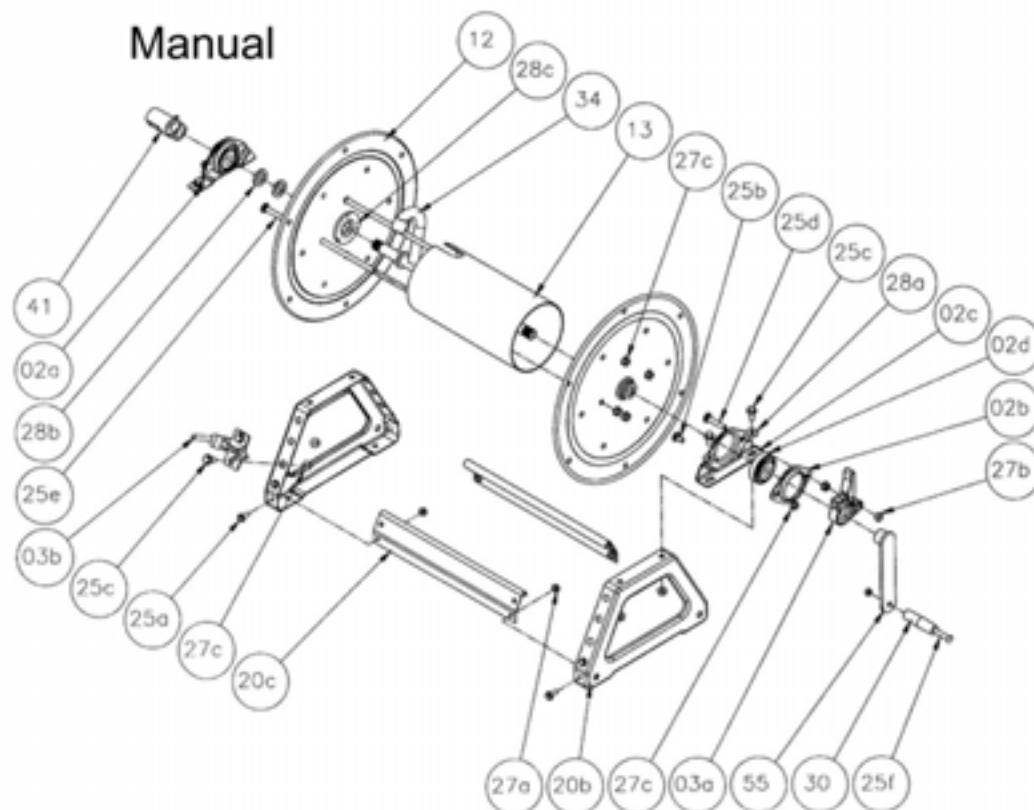
SPR-8876 75' - 100' Electric Reel
 SPR-8877 150' - 200' Electric Reel
 SPR-8878 300' Electric Reel

NORSTAR INSTRUMENTS INC.		2302 A St. S.E. Auburn WA 98002	
TITLE: INJECTION SKID HOSE REEL ASSEMBLY			
DRAWN BY: J GOULET	CHECKED BY:	SCALE: 1:7	PAGE: 1/1
DATE CREATED: 7/2/09	DRAWING NUMBER:	DATE REVISED:	



Item No.	Description	PART NUMBER	Quantity
02a	Self Aligning Bearing Complete - (1/2" Bore)	9902.1200	2
02b	Self Aligning Bearing Holder	9902.2800	2
02c	Self Aligning Bearing Pillowblock	9902.2900	2
02d	Self Aligning Bearing Insert - (1/2" Bore)	9902.1300	2
06	#35 Chain	9912.0028	1
07	Chain Guard, Molded	9957.0030	1
12	17-18 Disc	9903.0516	2
13	Drum - Aluminum - 6" Dia. (Specify Model)	9905.7112	1
20	Frame Assembly 1500 Series (Complete)	9908.1000	1
20a	Frame, 1500 Series	9906.0011	2
20b	Foot, 1500 Series	9907.6000	2
25a	1/4" - 20 X 1/4" Allen Set Screw	9958.0002	2
25c	1/4" - 20 x 3/4" Hex Washer Head Black Zinc Screw	9904.1071	2
25d	1/4" - 20 x 1/2" Hex Washer Head Tap Tight Screw	9904.1070	2
25e	5/16" - 18 x 3/4" Spinlock Bolt	9904.2101	12
25f	3/8" - 16 x 3/4" Bearing Bolt	9904.0201	4
25g	3/8" - 16 x 3/4" Spinlock Bolt	9904.2201	4
25h	3/8"-16 x 1" Button Head Cap Screw	9904.9202	6
25k	3/8" - 16 Carriage Bolt	Specify Model	4
25m	1/2"-13 x 1" Hex Head Bolt	9904.1402	2
27a	1/4" - 20 Spinlock Nut	9904.6000	2
27b	5/16" - 18 Spinlock Nut	9904.5602	8
27c	3/8" - 16 Spinlock Nut	9904.6200	18
27d	1/2" - 13 Hex Head Nut	9904.5400	2
28a	3/8" Flat Washer	9954.0007	4
28b	Disc Sprocket Spacer	9954.0015	6
28c	Hub Spacer	9954.0020	As Req'd
28d	Disc Washer	9965.0040	2
34	1/2" Hub Assembly w/ 1/2" FIPT Riser Outlets	9901.0610	1
41	1/2" 90 Deg Steel 5000 Psi Super Swivel Joint	9927.8551	2
55c	1/2" Pipe Cap	9965.0013	1
58	227 12V DC Non Explosion Proof Motor (Face Mount)	9915.0042	1
66	Motor Mounting Plate - Electric Motor	9923.0006	1
72	11T35 x 1-3/4" Motor Sprocket - Electric Motor	9910.1119	1
72a	112T35 x 13-3/8" Dia Disc Sprocket	9910.1321	1

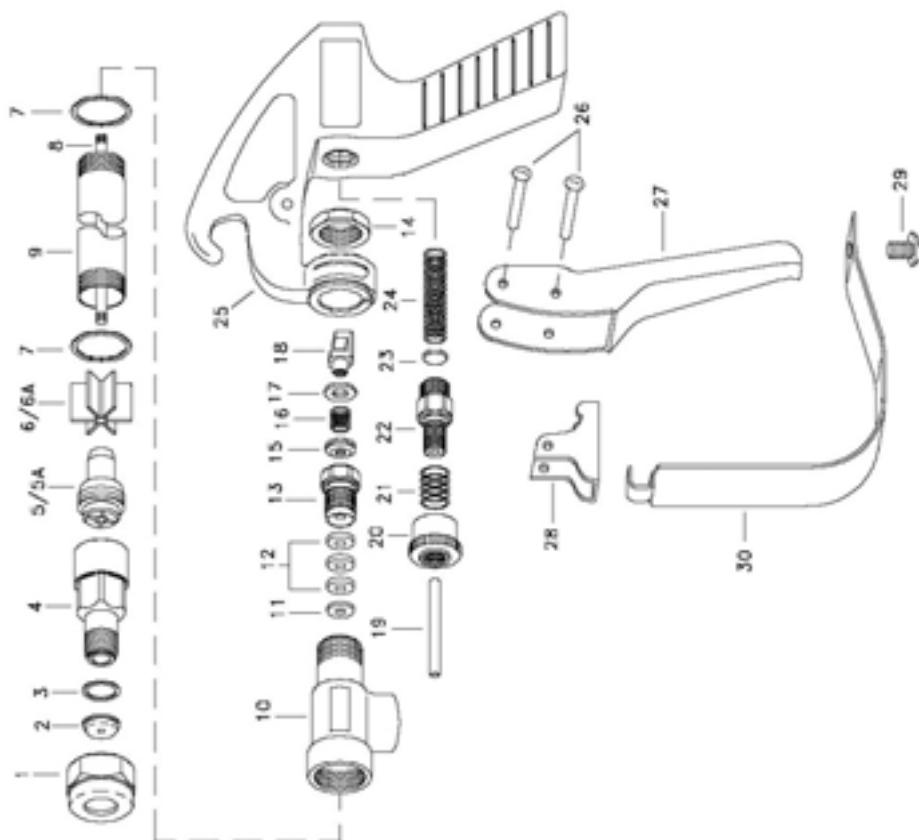
Manual



Item No.	Description	PART NUMBER	Quantity
02a	Self Aligning Bearing Complete - (1/2" Bore).....	9902.1200	2
02b	Self Aligning Bearing Holder	9902.2800	2
02c	Self Aligning Bearing Pillowblock.....	9902.2900	2
02d	Self Aligning Bearing Insert - (1/2" Bore)	9902.1300	2
03a	Cam Lock Drag Brake (Includes Hardware)	9947.0130	1
03b	PL-1 Pinlock	9965.0030	1
12	17-18 Disc	9903.0516	2
13	Drum - Aluminum - 6" Dia.	9905.7112	1
20a	Frame Assembly (Complete).....	9908.1000	1
20b	Frame.....	9906.0011	2
20c	Foot	9907.6000	2
25a	5/16" - 18 x 1/2" Spinlock Bolt.....	9904.2158	8
25b	3/8" - 16 x 3/4" Bearing Bolt.....	9904.0201	3
25c	3/8" - 16 x 3/4" Spinlock Bolt	9904.2201	6
25d	3/8" - 16 x 2" Bearing Bolt.....	9904.0206	1
25e	3/8" - 16 Carriage Bolt.....	Specify Model	4
25f	Hand Crank Handle Bolt (w/ Nut).....	9914.0511	1
27a	5/16 - 18 Spinlock Nut.....	9904.5602	8
27b	3/8 - 16 Hexhead Nut (ESNA for Cam Lock Brake).....	9904.5201	1
27c	3/8 - 16 Spinlock Nut.....	9904.6200	14
28a	3/8" Flat Washer	9954.0007	4
28b	Hub Spacer	9954.0020	As Req'd
28c	Disc Washer	9965.0040	2
30	Hand Crank Handle.....	9914.0506	1
34	Hub Assembly - 1/2" FIPT Riser Outlet.....	9901.0610	1
41	1/2" 90 Deg F x F Super Swivel Joint.....	9927.8551	1
55	Hand Crank	9914.0021	1

ITEM	PART NO.		DESCRIPTION
	BRASS	ALUMINUM	
1	CP1325	CP1325-AL	Cap, Brass or Aluminum
2	D-**	D-**	Orifice Disc, Hardened Stainless Steel
3	CP4743-NY	CP4743-NY	Gasket, Nylon
4	CP10566	CP10566-AL	Nozzle Housing, Brass or Aluminum
5	10565-1-NY	10565-1-NY-AL	Seat Plug, Seal Plate, Washer & Core Sub-Assembly Nylon Core With Brass Or Aluminum Seat Plug
5A	10565	10565-AL	Seat Plug, Seal Plate, Washer & Core Sub-Assembly Brass Or Aluminum Seat Plug (SPECIAL ORDER ONLY)
6	CP10571-2-NYB	CP10571-3-NYB	Guide Vane, Nylon
6A			Guide Vane, Aluminum (SPECIAL ORDER ONLY)
7	CP45195-NYB	CP45196-NYB	Gasket, Nylon (Back) 2 Req'd
8	CP19239-416SS	CP19239-416SS	Stem, Type 416 Stainless Steel
9	CP6871	CP6871-AL	Tubing, Brass or Aluminum
10	CP6492	CP6492-AL	Inlet Body, Brass or Aluminum
11	CP6601-302SS	CP6601-302SS	Packing Washer, Type 302 Stainless Steel
12	CP6602-LEA	CP6602-LEA	Packing, Leather (3 Req'd), Standard
12	CP6602-TTF	CP6602-TTF	Packing, Teflon (3 Req'd), Optional
13	CP19237	CP19237-AL	Packing Screw, Brass or Aluminum
14	CP6599-NP	CP6599-NP	Locknut, Brass, Nickel Plated
15	CP6641-NP	CP6641-NP	Stem Nut, Steel, Nickel Plated
16	CP6595-SS	CP6595-SS	Trigger Stop Spring, Stainless Steel
17	CP7991-SS	CP7991-SS	Washer, Stainless Steel
18	CP6597-NP	CP6597-NP	Trigger Guide, Steel, Nickel Plated
19	CP6591-SS	CP6591-SS	Spring Stud, Stainless Steel
20	CP6589-7P	CP6589-7P	Stop Adjustment Nut, Steel, Zinc Plated
21	CP6594-SS	CP6594-SS	Spring for Stop Adjustment Nut, Stainless Steel
22	CP6588-7P	CP6588-7P	Spring Screw, Steel, Zinc Plated
23	CP6592-302SS	CP6592-302SS	Spring Guide Washer, Type 302 Stainless Steel
24	CP6593-1-SS	CP6593-1-SS	Main Spring, Stainless Steel (for Model #43A-)
24	CP6593-2-SS	CP6593-2-SS	Main Spring, Stainless Steel (for Model #43A-)
25	CP14477-1-AL	CP14477-1-AL	Gun-Jet Body, Aluminum
26	CP7623-7P	CP7623-7P	Rivet, Steel, Zinc Plated (2 Req'd)
27	CP6509-NP	CP6509-NP	Trigger, Steel, Nickel Plated
28	CP6510-NP	CP6510-NP	Trigger Stop, Steel, Nickel Plated
29	CP11757-SS	CP11757-SS	Screw, Stainless Steel
30	CP13798-NP	CP13798-NP	Trigger Guard, Steel, Nickel Plated
Gun-Jet® No. AA43A = Brass, Complete, For Pressures up to 200 PSI			
Gun-Jet® No. AA43A-AL = Aluminum, Complete, For Pressures up to 200 PSI			
Gun-Jet® No. AA43HA = Brass, Complete, For Pressures from 200 to 800 PSI			
Gun-Jet® No. AA43HA-AL = Aluminum, Complete, For Pressures from 200 to 800 PSI			
PK-A943-KIT Spare parts Kit (includes all items marked with *)			
PK-A943-AL-KIT Spare parts Kit (includes all items marked with *)			
ABC43A-KIT Conversion Kit for Adjustable Stem - Items 8, 13 & 15 (for Model #43A-)			
ABC43A-AL-KIT Conversion Kit for Adjustable Stem - Items 8, 13 & 15 (for Model #43A-AL-)			

** Specify Orifice Disc Size



DESCRIPTION:
No. 43A & 43HA
GUN-JET® SPRAY GUNS
(4 INCH EXTENSIONS)

Spraying Systems Co.
Spray Nozzles and Accessories
P.O. Box 7900 - Wheaton, IL 60189-7900

Rev. No. 1

Parts List No.

Ref.

PL 43A

SHEET

OP

DISASSEMBLY PROCEDURE: (See Parts Lists PL 43, 43A)

If it becomes necessary to disassemble this unit remove spray gun from supply hose and follow these steps:

1. Use an adjustable wrench to hold the flats of the Inlet body (10) and another wrench on the hex of the nozzle housing (4) to unscrew assembly. Either nozzle housing (4) or tubing (9) will unscrew.
2. Lock trigger (27) in open position using trigger stop (28).
3. Unscrew lock nut (14) and slide inlet body (10) out of handle body (25).
4. Loosen screw (29), disengage upper end of trigger guard (30) and swing trigger guard (30) to side.
5. Squeeze trigger (27) to disengage trigger stop (28) and allow trigger (27) to swing backward against handle body (25).
6. Disengage trigger guide (18) from lower rivet (26) and remove inlet body (10) and stem assembly (8) from the handle assembly.
7. Using a wrench on the trigger guide (18) and another wrench on the flats of the stem (5), unscrew trigger guide (18). Remove trigger spring (16), washer (17) and stem nut (15).
8. Withdraw stem (8) from inlet body (10).
9. Using a wrench on the flats of the stem (8) and another wrench on the flats of the seat plug (5), unscrew seat plug (5) and discard.
10. Remove packing screw (13) from inlet body (10).
11. Remove and discard the three pieces of packing (12) and packing washer (11). Use care to avoid damaging the internal threads on the inlet body (10).
12. If desired, stop adjustment nut (20) can be unscrewed until the hex on the spring screw (22) is exposed to allow for removal of items 19-24.
13. Clean and inspect all parts. Replace worn or damaged parts.

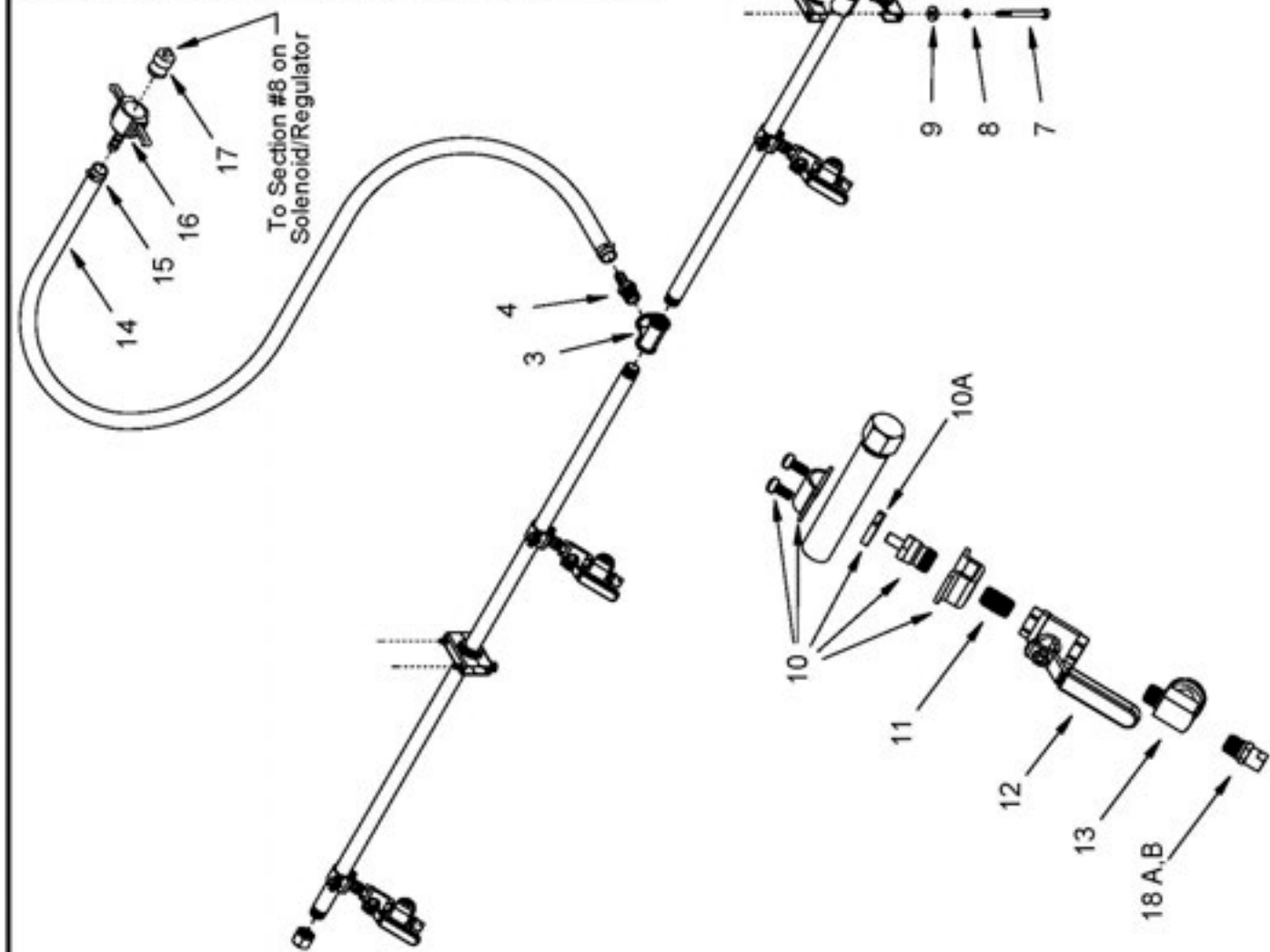
ASSEMBLY PROCEDURE: (See Parts Lists PL 43, 43A)

1. If previously disassembled, install spring (21) on spring screw (22). Screw stop adjustment nut (20) on spring screw (22) with the small diameter end facing the hex until the large diameter end of the stop adjustment nut (20) is flush with the end of the spring screw (22).
2. Slide spring stud (19) in spring screw (22).
3. Install main spring (24) and spring guide washer (23) followed by spring screw assembly (items 19-22) into handle body (25). Tighten spring screw (22) with wrench. (Stop adjustment nut (20) may be backed off to allow more wrench clearance.) After tightening spring screw (22), tighten stop adjustment nut (20) "to allow for full trigger (27) movement.
4. Install guide vane (6) and new seat plug (5) on stem (8). Tighten securely using wrenches on flats of stem (8) and seat plug (5).

ASSEMBLY PROCEDURE: (Cont.)

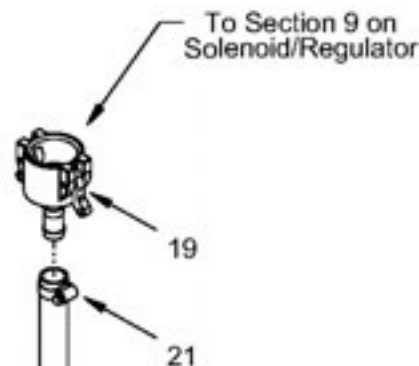
5. Install new gasket (7) in inlet body (10) and slide inlet body (10) onto stem (8) with large diameter end toward seat plug (5). Slide new packing washer (11), three pieces of new packings (12) followed by the threaded end of packing screw (13) on stem (8).
 6. While holding packing screw (13) carefully screw inlet body (10) over packings (12) to engage threads on packing screw (13). Tighten finger tight only.
 7. Tighten stem nut (15) fully on stem (8) with undercut side of stem nut (15) facing away from inlet body (10).
 8. Install new washer (17) on new trigger guide (18) followed by new trigger stop spring (16). Thread trigger guide (18) on stem (8) until end of stem (8) is flush with the inner edge of trigger guide (18) then back off two turns and use wrench to tighten against stem nut (15).
- Note:** trigger stop spring (16) should fit neatly inside of undercut on stem nut (15). If not, then stem nut (15) was installed backwards.
9. Position non-beveled side of Jock nut (14) against handle body (25) between trigger (27) and handle body (25) and swing trigger (27) forward against lock nut (14).
 10. With open end of trigger guide (18) pointing toward top of handle body (25), hook trigger guide (18) on lower rivet (26). Pull back partially on trigger (27) and place trigger guard (30) in slot on handle body (25).
 11. Slide inlet body (10) into handle body (25) and secure with lock nut (14).
 12. Install tubing (9), new gasket (7) and nozzle housing (4). Tighten securely using wrenches on flats on inlet body (10) and hex on nozzle housing (4).
 13. The trigger (27) should appear to be vertical with the gun held horizontally. If desired, additional adjustment of stroke can be made by locking the trigger (27) open, backing off stem nut (15) slightly and using needle nose pliers on the flats of the stem (8) to rotate stem (8). Lock stem nut (15). Stroke can be shortened as well as lengthened for final adjustment but if stop adjustment screw (20) disengages from spring screw (22), stroke must be shortened.
 14. Install gun in system and carefully check for leaks by starting at low pressures. Additional tightening of packing screw (13) may be required if leaks at packings (12) are found. Tighten only enough to stop leakage.
 15. Make sure trigger lock (20) is in "locked off" position. Do not turn on the pump power or operate spray gun if trigger lock is not operating properly.

Item	Qty	Part Number	Description
1	2	FAB-2743	Brass Spray Bar Tube
2	2	BRF-CAP-08FP	1/2" Brass Pipe Cap
3	1	BRF-TEE-08FP	1/2" Brass Tee
4	1	BRF-SBR-08BX08MP	1/2" Brass Hose Barb
5	2	LHA-G16-8P	Rubber Bushing
6	4	LHA-HC16-1-2	Mounting Bracket
7	2	FAS-SHC-5/16-18X2 1/2-S	Hex Cap Screw
8	2	FAS-WLO-5/16-S	Lock Washer
9	2	FAS-WUS-5/16-S	USS Washer
10	4	SPS-7421 1/2 CT	Split Eyelet Assembly
10A	1	SPS-7418-BU	Split Eyelet Gasket
11	4	BRF-NIP-04MP	1/4" Brass Nipple
12	4	LHA-BV04N	1/4" Brass Ball Valve
13	4	SPS-10742A	Check Valve
13A	1	SPS-CP4620-FA	Diaphragm (Not Shown)
14	20'	HSE-7200-08	1/2" Bosflex Hose
15	2	FAS-7655-08	1/2" Gear Clamp
16	1	PPF-FQD-08B	Female Camlock
17	1	PPF-MQD-08X	Camlock Plug
18A	4	SPS-H1/4U0520	35 GPA Spraybar Nozzle
18B	4	SPS-H1/4U0515	25 GPA Spraybar Nozzle

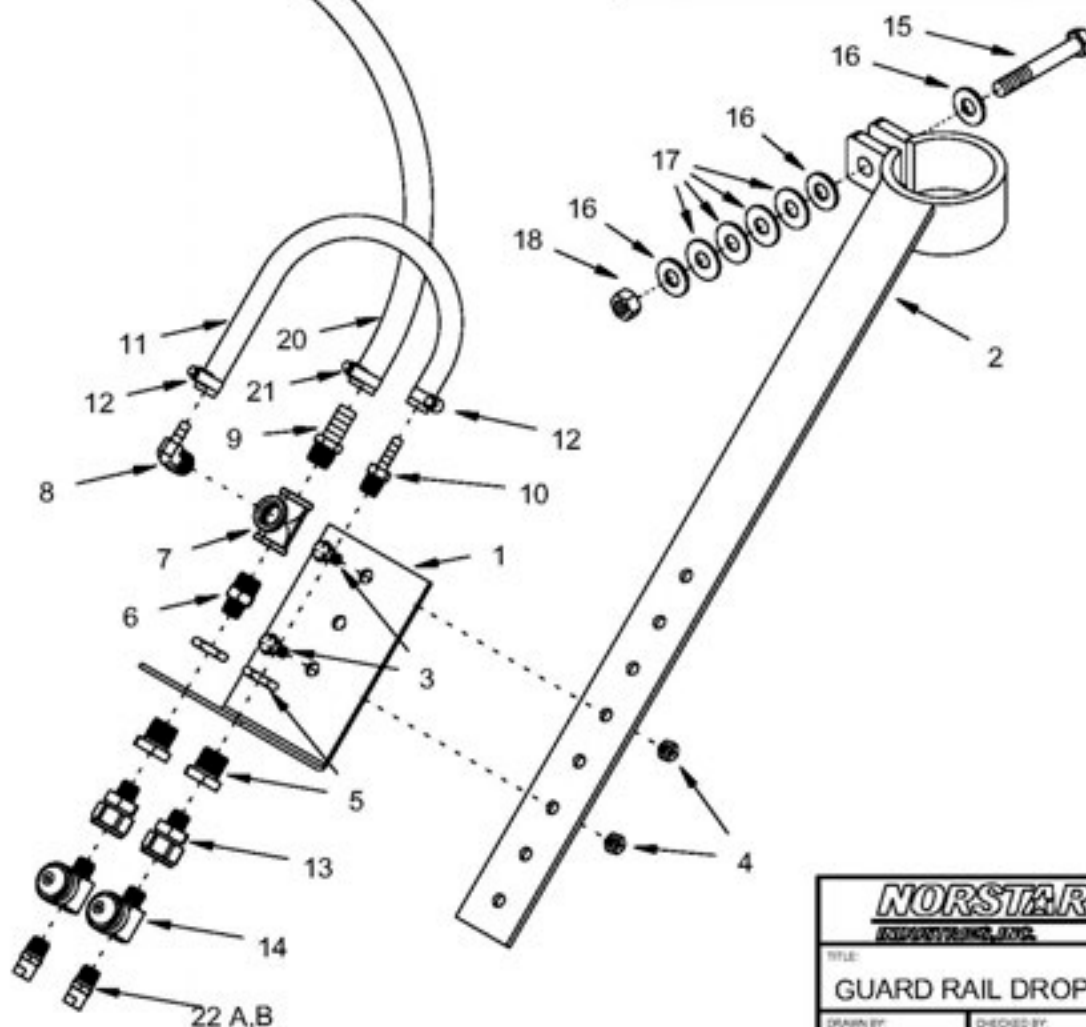


NORSTAR
 2302A St. S.E.
 Auburn WA 99802
 800.337.2553 FAX 509.337.2553

TITLE SPRAY BAR			
DRAWN BY J GOULET	CHECKED BY	SCALE 1:9	PAGE 1/1
DATE CREATED 8/22/03	DRAWING NUMBER NSC-90500	DATE REVISED	



Item	Qty	Part Number	Description
1	1	FAB-2065	Drop Nozzle Bracket
2	1	FAB-2063-SKID	Drop Nozzle Angle mount
3	2	FAS-SHC-5/16-18X3/4-S	5/16-18 x 3/4" Hex Cap Screw
4	2	FAS-NYS-5/16-18-S	5/16-18 Nyloc Nut
5	2	BRF-BHD-04FP	1/4 Brass Bulkhead Fitting
6	1	BRF-HXN-06MPX04MP	3/8" x 1/4" Brass Hex Nipple
7	1	BRF-TEE-06FP	3/8" Brass Tee
8	1	BRF-9BR-04BX06MP	3/8" x 1/4" Brass 90° Hose Barb
9	1	BRF-SBR-08BX06MP	1/2" x 3/8" Brass Hose Barb
10	1	BRF-SBR-04BX04MP	1/4" Brass Hose Barb
11	1'	HSE-7200-04	1/4" Bosflex Hose
12	2	FAS-7655-04	1/4" Gear Clamp
13	2	SPS-10742A	Check Valve 1/4"MPT x 1/4" FPT
14	2	SPS-36275-1/4X1/4	Ball Swivel 1/4"MPT x 1/4" FPT
15	1	FAS-SHC-3/8-16X2 1/2-S	3/8-16 x 2 1/2" Hex Cap Screw
16	3	FAS-WUS-5/16-S	5/16" USS Washer
17	4	FAS-WBV-3/8-S	3/8" Belleville Washer
18	1	FAS-NYS-3/8-16-S	3/8-16 Nyloc Nut
19	1	PPF-FQD-08B	Female Camlock
20	8'	HSE-7200-08	1/2" Bosflex Hose
21	2	FAS-7655-06	3/8" Gear Clamp
22A	2	SPS-H1/4U5015	35 GPA Nozzle Set
22B	2	SPS-H1/4U5010	25 GPA Nozzle Set



<u>NORSTAR</u> <u>MANUFACTURING, INC.</u>		2302 A St. S.E. Auburn WA 98002	
TITLE: GUARD RAIL DROP NOZZLE ASSEMBLY			
DRAWN BY: J GOULET	CHECKED BY:	SCALE: 1:5	PAGE: 1/1
DATE CREATED: 2/1/13	DRAWING NUMBER: NSC-20320-SKID	DATE REVISED:	

WARRANTY STATEMENT

NORSTAR INDUSTRIES, INC. warrants to Purchaser for use, that, if any part of the product proves to be defective, in material or workmanship, within one (1) year from date of original installation, and is returned to NORSTAR INDUSTRIES, INC. within thirty (30) days after such defect is discovered, NORSTAR INDUSTRIES, INC. will, (at its option) either replace or repair said part. All returns shall be authorized prior to shipment. Freight will be prepaid by customer.

This warranty does not apply to normal deterioration, due to wear and/or exposure to the elements, damage resulting from misuse, neglect, accident, improper installation and/or maintenance, or use of non-compatible chemicals.

Said part will not be considered defective if it substantially fulfills the performance specifications.

Auxiliary power equipment resold by NORSTAR INDUSTRIES, INC. (gasoline engine) is warranted by the manufacturer, **NOT** by NORSTAR INDUSTRIES, INC. Electronic components are not to be disassembled, without the express written permission of NORSTAR INDUSTRIES, INC.

In the event of a defect in the sprayer control or injection pump, Norstar Industries, Inc. will provide a loaner injection sprayer control (computer) and/or injection pump, within twenty four (24) hours from the time user and Norstar Industries determine repairs cannot be made in the field.

Defective parts returned to NORSTAR INDUSTRIES, INC. must include a packing slip with the following information: Sprayer Model, Serial Number, Date Installed, Dealer from whom purchased.

NORSTAR INDUSTRIES, INC. neither assumes, nor authorizes anyone to assume for it, any other obligation or liability in connection with said part, and will not be liable for consequential damages.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES OF MERCHANTABILITY FITNESS FOR PURPOSE AND OF ANY OTHER TYPE, OF WARRANTY, WHETHER EXPRESS, OR IMPLIED. NO AGREEMENT MODIFYING, OR EXTENDING THIS WARRANTY, WILL BE BINDING ON NORSTAR INDUSTRIES, INC., UNLESS IN WRITING AND SIGNED BY AN AUTHORIZED EMPLOYEE OF NORSTAR INDUSTRIES, INC.